Cement MILL SECTION of

Concrete

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Trinity Portland Cement Company Expands

By W. H. L. McCourtie
President, Trinity Portland Cement Co.

The Trinity Portland Cement Co., organized in 1907 by Cowham and McCourtie, has started the construction of a 500,000-bbl. cement plant immediately adjoining the north city limits of Fort Worth, Texas, along both the Santa Fe and Rock Island Railways, and the Azle and Saginaw Pikes. This plant will be operated in conjunction with the company's plant now located at Dallas, and upon completion of the Fort Worth unit, will give the Trinity Portland Cement Co. an annual output of approximately 2,000,000 bbls. While this increased production is somewhat in excess of the present demand for cement in this territory, it is the desire and intention of the Trinity company to be prepared in advance for any abnormal demand that may possibly arise.

The Dallas Plant

The Dallas plant of the Trinity company, which is located on the Texas & Pacific and Santa Fe Railways and the Dallas and Fort Worth Pike, was put in commission in 1909, with an initial annual capacity of 750,000 bbls. With a desire to keep abreast of the times, improvements and extensions have from time to time been installed until at present the Dallas plant's capacity is approximately 1,500,000 bbls. per annum.

Among some of the major improvements above referred to may be mentioned the installation of a more efficient initial crushing system, waste heat power plant, oversized kiln-burning zones, modern packing house, and an additional 120,000-bbl. capacity modern cement silo storage. Because of the softness of the rock, the Dallas plant is also now discontinuing the use of steam shovels, blast hole drills and blasting powder in the quarry, replacing the same with two Stephens-Adamson excavators,[1] with a capacity of 1500 tons of rock per day.

The Dallas quarry, with approximately a 50-ft. depth of lime rock, underlaid with shale, is located about 400 yds. from the plant. At present, the materials are handled by two Marion steam shovels[2] (operating in a manner to obtain an approximate mix in the quarry), and are transported from the quarry to the plant crusher by two Vulcan saddle tank locomotives,[3] with 26-yd. standard gauge side dump cars. The original initial crushing equipment consisted of a No. 9 gyratory crusher which, while very efficient from an upkeep standpoint was, because of the particular character of the materials—which have a tendency to slip and ride—later replaced by a 36-in. x 60-in. Fairmount roll crusher[4] of a capacity of 250 tons of rock per hour. Because of the present installation of the excavators above referred to, which deliver the rock of a size that will practically eliminate initial crushing, the operation of this Fairmount roll crusher is also soon to be discontinued. The materials are now delivered from the Fairmount roll crusher to a No. 7 Williams mill,[5] and thence into a 10,000-ton rock storage. A separate shale storage house and analysis bins are provided for

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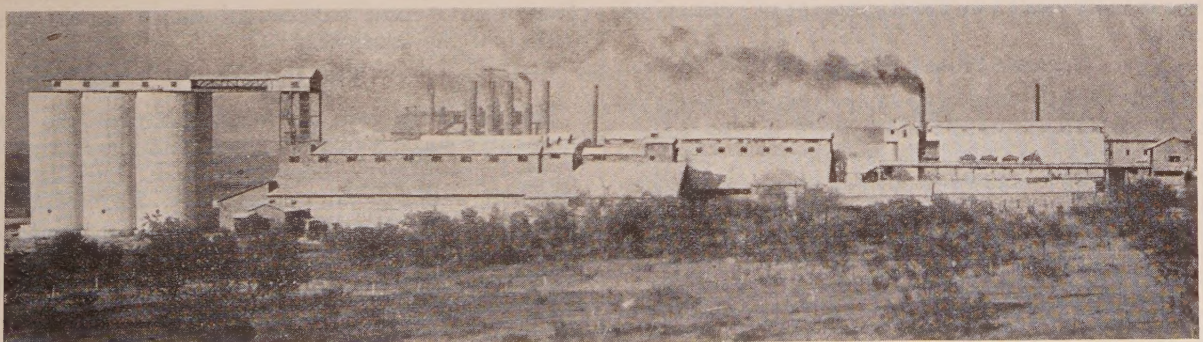
[1] Stephens-Adamson Mfg. Co., Aurora, Ill.
[2] Marion Steam Shovel Co., Marion, Ohio.
[3] Vulcan Iron Works, Wilkes-Barre, Pa.
[4] Allis-Chalmers Mfg. Co., Milwaukee, Wis.
[5] Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.



Plant of Trinity Portland Cement Co., Dallas, Texas correcting the mix. The dry process prevails in this plant, and two 6-ft. x 70-ft. rock dryers and one similar sized clay dryer—burning fuel oil—eight Krupp ball mills,[6] and eight 5-ft. x 22-ft. Gates tube mills[7] constitute the remainder of the raw end of the plant.

The Dallas plant has five kilns. Two of these, with special burning zones, are 10 ft. x 8 ft. x 125 ft., and the remaining three are 8 ft. x 125 ft. The result of the operation of the oversized burning zones above referred to, both in fuel efficiency and increased production, has more than justified the expectations of the management. From a 75,000-bbl. capacity clinker storage the clinker is delivered through a 6-ft. x 70-ft. cylinder cooler to the finish grinding department, which consists of six Kent mills[7] in the preliminary and seven 5-ft. x 22-ft. Gates tube mills[4] in the finishing end. Mr. O. V. Bartholomew, the mill superintendent, has redesigned these Kent mills to some extent, and made improvements whereby the operating efficiency of these mills is very high. Installation of metal liners and metal grinding mediums in the finish tube mills has also greatly increased their efficiency and output—the present capacity being 42 bbls. per hour per mill.

The addition of the recently constructed cement storage house provides a total finished product storage capacity of 200,000 bbls., which adds much to the flexibility of operation and reduction of manufacturing costs per bbl. The two railways operate on opposite sides of the packing house, which is provided with eight Bates valve bag packers[8] that serve the same and also the truck loading platform.

The Trinity company's original power plant—consisting of three gas engines directly connected to three 750-KVA. alternators, operating first on producer gas and later on natural gas—has long since been abandoned and replaced with a modern waste heat steam turbine equipment. This wast heat power installation consists of three 110 h. p. Edge Moor waste heat boilers[9] with Foster superheaters,[10] Green fuel economizers,[11] radial flow fans, etc., and one 600-h. p. Edge Moor oil and gas direct fired auxiliary boiler, the latter being for emergency use only, when kilns are not in operation. Each waste heat boiler stack is connected with a 24-ft. cyclone dust collector—which collectors have demonstrated themselves 95% efficient. The prime movers are one 2500-K.W. Curtis vertical turbine[12] and one 5000-KVA. Allis-Chalmers horizontal turbine,[4] with Wheeler condensers[13] and all auxiliaries. The waste heat is transmitted from the kilns to the boilers through a common flue, and sufficient power is developed to operate the entire plant which, at present, has approximately 3900 connected motor horse power—all of which is produced at an extremely low cost.

The many improvements made during the past few years, together with a splendid organization of experienced operators, make this plant one of the most efficient in existence from the standpoint of economical operation.

Fort Worth Plant

The Fort Worth property, comprising 602 acres of limestone of almost perfect mix, which is also underlaid with shale, is particularly well located, both for railway and truck hauling transportation—being immediately adjacent to the north city limits of Fort Worth. This plant, which is now under construction, will be completed this year, and should be a most compact and efficient unit. Sanderson cyclone drills[14] are to be used for blast hole drilling. The quarry will be equipped with one 2½-yd. Marion steam shovel[2] and one 1½-yd. Marion steam shovel. The Woodford electric hauling system, requiring but one operator, will transport the materials from the quarry to the initial crusher—a Williams' Mammoth hammer mill[5] (equipped with Stephens-Adamson feeder)—capable of reducing 36-in. cubes to less than ¾ in. in the one operation, and of handling 250 tons of material per hour. A large continuous bucket roller type elevator at a 45° angle thereupon delivers the crushed materials to a concrete storage building 75 ft. x 360 ft. This building, which is equipped with a Shepard electric overhead grab basket crane[15] traveling the entire length of the building, provides individual bin storage for crushed rock, shale, clinker, and gypsum.

The wet process will be employed, and 7-ft. x 26-ft. Traylor Engineering & Manufacturing Co.'s three compartment combination mills[16] are to be used in both raw and finish grinding. The initial installation consists of one Reeves Bros. kiln,[17] 11 ft. 3 in. x 250 ft., burning fuel oil. A drag chain conveyor delivers the clinker from the kilns to storage. A belt conveyor carries the finished cement to a 100,000 bbl. capacity modern concrete silo type cement storage building. From a uniquely constructed packing house, equipped with Bates valve bag packers, the finished cement will be delivered directly to both railway and truck hauling platforms.

The machine shop (with overhead crane equipment), plant office, laboratory, and supply rooms are under one roof—80 ft. x 110 ft. x 30 ft. Owing to very favorable rate, electric power will be purchased for the time being—the layout, however, providing for waste heat installation later if desired.

The plant layout, which provides for additional units to a total of 6000 bbls. per day whenever needed, without great additional costs, is designed to practically eliminate troublesome elevators and conveyors—thus reducing to a minimum the handling of all materials—and 75 men should operate its initial capacity of 1650 bbls. per day. Because of simplicity of design, this company's Fort Worth plant should be the "last word" in cement mill construction. This, coupled with the experience of the Trinity company's organization of competent cement mill operators, should make the production cost per barrel of cement the minimum. Because of the proximity of these two Trinity plants, which are located but 40 miles apart, the management will be under one head, thus eliminating much unnecessary expense, which also further assists in maintaining low ultimate manufacturing costs.

Trinity's potential output of 2,000,000 bbls in 1925, coupled with plant flexibility allowing for further substantial increases, with but comparatively small outlay of labor and machinery, makes this company's two plant unit a most substantial factor in the cement market of the southwest.

The Personnel

The following men are responsible for the Trinity company's success in the cement manufacturing field: W. H. L. McCourtie, president; C. E. Ulrickson, vice president and general manager; A. S. Parsons, sales manager; O. V. Bartholomew, general superintendent; Charles Hurst, chief engineer; A. F. Miller, consulting engineer; J. W. Ganser, chief chemist; G. G. Tomlinson, traffic manager; J. J. Horgan, purchasing agent.

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[6] Thos. Prosser & Co., New York City.
[7] Kent Mill Co., Brooklyn, N. Y.
[8] Bates Valve Bag Co., Chicago, Ill.
[9] Edge Moor Iron Co., Edge Moor, Del.
[10] Power Specialty Co., New York City.
[11] Green Fuel Economizer Co., Beacon, N. Y.
[12] General Electric Co., Schenectady, N. Y.
[13] Wheeler Condenser & Engineering Co., E. Carteret, N. J.
[14] Sanderson Cyclone Drill Co., Orville, Ohio.
[15] Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.
[16] Traylor Engineering & Mfg. Co., Allentown, Pa.
[17] The Reeves Bros. Co., Alliance, Ohio.

Portland Cement Output in April, 1924

The April production of portland cement shows marked increase over March, but shipments increased at a much higher rate, thus reducing stocks by more than one million bbls. or about 6%. The seasonal increase in shipments has reversed the unprecedented growth of stocks shown during preceding months.

The statistics shown in the following tables, issued by the Department of the Interior, and prepared under the direction of Ernest F. Burchard, of the Geological Survey, are based mainly on reports of producers of portland cement, but in part on estimates. The estimates for April, 1924, were made necessary by the lack of returns from two plants.

Stocks of clinker, or unground cement, at the mills at the end of April, 1924, amounted to about 8,560,000 bbls., compared with 8,271,000 bbls. (revised) at the beginning of the month.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1923 AND 1924, IN BARRELS.

Month	Production		Shipments		Stocks at end of month	
	1923	1924	1923	1924	1923*a*	1924
January	*a* 7,990,000	8,788,000	*a* 5,628,000	5,210,000	11,477,000	*a*14,155,000
February	*a* 8,210,000	8,588,000	*a* 6,090,000	5,933,000	13,596,000	*a*16,815,000
March	9,880,000	10,370,000	10,326,000	8,995,000	13,045,000	*a*18,189,000
1st quarter	26,080,000	27,746,000	22,044,000	20,138,000	....	....
April	11,359,000	11,726,000	12,954,000	12,771,000	11,463,000	17,144,000
May	12,910,000	....	14,257,000	....	10,144,000	....
June	12,382,000	....	13,307,000	....	9,168,000	....
2nd quarter	36,651,000	....	40,518,000	....	....	....
July	12,620,000	....	13,712,000	....	8,081,000	....
August	12,967,000	....	14,971,000	....	6,080,000	....
September	13,109,000	....	13,698,000	....	5,533,000	....
3rd quarter	38,696,000	....	42,381,000	....	....	....
October	13,350,000	....	14,285,000	....	4,612,000	....
November	12,603,000	....	10,251,000	....	6,991,000	....
December	9,997,000	....	6,408,000	....	10,575,000	....
4th quarter	35,950,000	....	30,944,000	....	....	....
	137,377,000	....	135,887,000	....	....	....

a Revised.

The Bureau of Foreign and Domestic Commerce, of the Department of Commerce, reports that the imports of hydraulic cement in March, 1924, amounted to 160,517 bbls., valued at $254,745. The total imports in 1923 amounted to 1,678,636 bbls., valued at $2,964,098.

The imports in March were from Norway, 65,925 bbls.; Belgium, 63,030 bbls.; Denmark, 28,196 bbls.; Sweden, 2,806 bbls.; Canada, 560 bbls. The imports were received in the following districts; Los Angeles, 47,654 bbls.; Porto Rico, 29,406 bbls.; Hawaii, 29,310 bbls.; Washington, 20,756 bbls., which includes the 560 bbls. from Canada; Philadelphia, 17,455 bbls.; New York, 7,691 bbls.; San Francisco, 7,310 bbls.; Maine and New Hampshire, 935 bbls.

The exports of hydraulic cement in March, 1924, were 91,224 bbls., valued at $254,687, of which was sent to South America, 28,897 bbls.; Cuba, 27,948 bbls.; to the other West Indies, 6,512 bbls.; Central America, 13,771 bbls.; Mexico, 10,835 bbls.; Canada, 208 bbls.; and to other countries, 3,053 bbls. The total exports in 1923 amounted to 1,001,688 bbls., valued at $2,944,174.

The statistics of imports and exports of hydraulic cement in April, 1924, are not available.

IMPORTS AND EXPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1923 AND 1924, IN BARRELS(a)

Month	Imports		Exports	
	1923	1924	1923	1924
January	71,686	153,732	74,169	88,586
February	20,529	162,930	88,531	62,606
March	66,521	160,517	98,861	91,224
April	76,899	(b)	85,662	(b)
May	88,480	......	103,634	......
June	111,559	......	77,203	......
July	286,106	......	82,774	......
August	324,008	......	73,201	......
September	215,785	......	77,121	......
October	172,051	......	74,302	......
November	140,590	......	85,743	......
December	104,422	......	80,487	......
	1,678,636		1,001,688	

(a) Compiled from records of the Bureau of Foreign and Domestic Commerce.
(b) Imports and exports in April, 1924, not available.

New Freight Rate in Kansas Gas Belt

A new scale of freight rates on cement has been prescribed by the Interstate Commerce Commission, effective May 14, on shipments from points in the Kansas Gas Belt, including Dewey, Okla., over interstate routes to Oklahoma points. The former rates were found unreasonable and unduly preferential of mills at Ada, Okla., Bonner Springs, Kan., and Sugar Creek, Mo., on complaint of the Iola Cement Mills Traffic Association and others.

New rates on cement from Ada, Okla., to points in Kansas also have been established by the Commission on the finding that the former rates were preferential of cement manufacturers at Bonner Springs, Kan.

Alien cement and steel workers who left this country for their native Hungary, Poland and Austria, immediately after the close of the great world war are for the most part returning according to a steam ship agent in Allentown, Pa.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS IN APRIL, 1293 AND 1924, AND STOCKS IN MARCH, 1924, IN BARRELS

Commercial District	Production		Shipments		Stocks at end of April		Stocks at end of March 1924*a*
	April		April				
	1923	1924	1923	1924	1923*a*	1924	
Eastern Pa., N. J., & Md.	2,996,000	3,024,000	3,554,000	3,361,000	3,778,000	4,392,000	4,729,000
New York	514,000	656,000	624,000	613,000	804,000	1,301,000	1,258,000
Ohio, Western Pa., & W. Va.	1,145,000	981,000	1,247,000	999,000	1,042,000	1,918,000	1,936,000
Michigan	551,000	615,000	598,000	679,000	640,000	888,000	952,000
Ill., Ind., & Ky	1,924,000	1,723,000	2,405,000	1,973,000	1,301,000	2,703,000	2,954,000
Va., Tenn., Ala., & Ga.	573,000	886,000	635,000	933,000	213,000	750,000	797,000
Eastern Mo., Ia., & Minn	1,018,000	982,000	1,197,000	1,251,000	1,694,000	2,519,000	2,788,000
Western Mo., Neb., Kan., & Okla	855,000	895,000	940,000	1,036,000	883,000	1,124,000	1,265,000
Texas	360,000	404,000	347,000	463,000	284,000	337,000	396,000
Colo. & Utah	245,000	204,000	218,000	219,000	163,000	196,000	211,000
Calif	917,000	1,017,000	924,000	970,000	139,000	418,000	370,000
Ore., Wash. & Mont	261,000	339,000	265,000	274,000	522,000	598,000	533,000
	11,359,000	11,726,000	12,954,000	12,771,000	11,463,000	17,144,000	18,189,000

a Revised.

The Exothermic Reaction of Portland Cement Clinker Formation

The exothermic reaction of portland cement clinker formation is treated in Pamphlet No. 3 issued by the British Portland Cement Research Association as compiled by Goeffrey Martin, director of research of the British Portland Cement Research Association and Walter J. Cooper. Early work of the exothermic reaction of clinker formation is reviewed including Joseph W. Richards' researches, LeChatelier's work, Soper's results, Tschernobaeff's work, Dormann's work, Coghlan's work, Tschernobaeff's direct determination of the exothermic reaction of clinker formation, Eldred's experiments at Swanscombe and Bamber's conclusion on the Eldred experiments. The determination of the exothermic reaction of clinker formation by means of heat curves as reviewed in the pamphlet include Dittler's work, National Physical Laboratory experiments, Janecke's experiments and Endell's experiments.

The determination of the exothermic reaction by solution in acids includes Jesser's work and Nacken's researches.

The summary is based upon a study of the part of the work reviewed as mentioned in the preceding paragraph.

SUMMARY

Four distinct methods have been used for determining the value of the exothermic reaction of clinker formation.

These methods are:

Method (1) By determining the heat of formation of the component silicates and aluminates which form clinker and calculating therefrom the heat of formation of clinker itself. (Richards, LeChatelier, Dormann, Coghlan.)

Method (2) By direct determination in the Bomb Calorimeter using charcoal as the source of heat (Tschernobaeff.)

Method (3) By means of heat curves. (Dittler, National Physical Laboratory, Janecke, Endell.)

Method (4) By solution of the raw materials and clinker in acids and measuring the thermal effects involved. (Jesser, Nacken.)

The following table is a summary of the more important determinations:

By studying the accompanying table it will be seen that the researches carried out between 1911 and 1922 enable us to form a fairly close estimate of the heat liberated in the exothermic reaction of clinkering, so that this problem, which during the last 20 years has been the subject of so much controversy, now appears to be well on the way to settlement.

The correspondence of the last two values in the table is remarkably close when we consider that they were obtained by entirely different methods using every resource of science in order to obtain exact results.

OTHER EXOTHERMIC REACTIONS

In addition to the exothermic reactions which occur, (a) When the clay portion of the raw material has been dehydrated but before sintering or clinkering takes place, (b) When the decarbonated mixture combines to form cement clinker, there are in practice other reactions which give rise to the evolution of heat. Some of these it would be difficult or impossible to detect by means of a heat curve as they would be masked by the possibly greater endothermic reactions proceeding at the same time.

The most important of them are mentioned below, but with the exception of the first, they are not likely to be of great importance owing to the small percentages of the relative compounds. They do, however, all add their quota to the sum of the heat evolved.

1. Combustions of any organic matter present naturally, in the form of peaty matter, bitumen or other carbonaceous matter. This may reach considerable proportions but may more properly be regarded as the combustion of adventitious fuel.

2. Oxidation of ferrous compounds to the ferric state. The heat evolved in the process of oxidizing 1 gram of ferrous oxide (FeO) to ferric oxide (Fe_2O_3) is 455.4 gram calories, equivalent to 819.7 B.t.u.'s per lb.; or 1,836,200 B.t.u.'s per ton; or 462,700 kilo calories per ton; or 0.06507 ton of standard coal (of 12,600 B.t.u.'s per lb.) per ton of ferrous oxide oxidized. From these data (the composition of the material being known) the value of the reaction per ton of clinker can be readily calculated.

3. Oxidation of sulfides, usually ferrous sulfides (FeS) in clays containing organic matter, and pyrites (FeS_2) in rocks and in some clays and shales.

The heat evolved in the oxidation of 1 gram ferrous sulfide (FeS) to ferric oxide (Fe_2O_3) is 1657 gram calories, equal to 2982.5 B.t.u.'s per lb.; or 6,681,000 B.t.u.'s per ton; or 1,684,000 kilo calories per ton; or 0.2367 ton of standard coal (of 12,600 B.t.u.'s per lb.) per ton of FeS oxidized.

In the case of pyrites (FeS_2) the figures would be rsepectively 1,620 g. calories per gram; or 2,916 B.t.u.'s per lb.; or 6,532,000 B.t.u.'s per ton; or 1,646,000 kilo calories per ton; or 0.2314 ton of standard coal (of 12,600 B.t.u.'s per lb.) per ton of FeS_2 completely oxidized to Fe_2O_3 and SO_2.

The heat resulting from the combination of the liberated and oxidized sulfur with the lime present is 3204.5 gram calories for each gram of sulfur, equivalent to 5,768 B.t.u.'s per lb.; or 12,920,000 B.t.u.'s per ton or 3,256,000 kilo calories per ton, or 0.4577 ton of standard coal (of 12,600 B.t.u.'s per lb.) per ton of sulfur originally combined with iron in the mixed raw material for cement.

4. Combination of oxidized sulfur derived from the combustion of the fuel used with the lime present.

The heat evolved in the formation of 1 gram of calcium sulfate from lime, sulfur dioxide and oxygen is 753.8 gram calories for each gram of calcium sulfate formed—equivalent to 1,357 B.t.u.'s per lb.; or 3,040,000 B.t.u.'s per ton; or 766,000 kilo calories per ton; or 0.1077 ton of standard coal (12,600 B.t.u.'s per lb.) per ton of $CaSO_4$ formed.

From these data, taking the amount of calcium sulfate in the finished clinker and deducting therefrom the amount due to that originally present in the raw material and that derived from sulfides originally present in the raw material, the value of the reaction may be readily assessed.

It may sometimes happen when sulfides or calcium sulfate are present in the raw material, especially if in notable quantities, that there is less calcium sulfate in the finished clinker than these quantities would represent, in which case any heat evolution would be limited to the oxidation of the original sulfur and its combination with lime less the heat absorbed by decomposition of the deficient quantity of calcium sulfate.

HEAT EVOLVED DURING THE EXOTHERMIC REACTION OF CLINKER FORMATION

Authority	Date	Equivalent in tons of standard coal (of 12,600 B.t.u.'s per lb.) per 100 tons clinker	B.t.u.'s per 100 tons clinker	Kilo-Calories per 100 kilos clinker	Method of Determination	Remarks
J. W. Richards	1904	5.920	167,084,000	41,430	Calculated from Berthelot's values for the heat of formation of the calcium silicates	Much too high
H. Le Chatelier	1905	2.651	74,860,000	18,560	Calculated from Le Chatelier's values for the heat of formation of calcium silicate	Too high
E. C. Soper	1905	2.267	64,000,000	15,870	do. do.	Too high
D. Tschernobaeff	1911	1.91 to 1.96	53,830,000 to 55,240,000	13,350	Direct determination by burning calcium carbonate and clay to cement in a bomb calorimeter in presence of charcoal as heating agent.	
O. Dormann	1914	1.606 to 1.628	44,330,000 to 44,960,000	11,240 to 11,400	Calculated from Tschernobaeff's 1905 determinations of the heat of formation of the calcium silicates and aluminates.	
R. Coghlan	1920	1.416	39,977,000	9,916	Calculated from Tschernobaeff's and Wologdine's 1912 determination of the heat formation of the calcium silicates and aluminates	
R. Nacken	1922	1.428	40,323,000	10,000	Direct determination by solution of materials in HCl and HF acids and measuring the thermal changes.	

The heat absorbed in decomposing 1 gram of calcium sulfate and liberating its lime is 753.8 gram calories; equivalent to 1357 B.t.u.'s per lb.; or 3,040,000 B.t.u.'s per ton; or 766,000 kilo calories per ton; or 0.1077 ton of standard coal (of 12,600 B.t.u.'s per lb.) per ton of $CaSO_4$ decomposed.

The heat evolved when 1 gram of ferrous carbonate ($FeCO_3$) is converted to ferric oxide and carbon dioxide is 73.8 gram calories; equivalent to 132.8 B.t.u.'s per lb.; or 297,500 B.t.u.'s per ton; or 0.1054 ton of standard coal (of 12,600 B.t.u.'s per lb.) per ton of $FeCO_3$ decomposed

General Conclusions

The foregoing summary of the literature shows that there is disagreement among research workers as to the value of the exothermic reaction of portland cement clinker formation.

Further investigation is desirable and in the first case it would be desirable to repeat the work of Tschernobaeff and Nacken using materials of different compositions in order to obtain results relative to highly limed, highly silicious, highly aluminous and average cements.

By working on dual lines valuable data will probably be obatined and the results obtained by means of the bomb calorimeter and by the use of heat curves will check one another.

A bibliography listing important literature on the exothermic reaction of clinker formation is followed by three papers appended to the report. These papers are: The Heat Effect of the Formation of Cement Clinker by D. Tschernobaeff, 1911, translated into German by D. C. Chorower, Barcelona; Thermo-chemical Investigations on the Sintering of Portland Cement Raw Meal, by E. Dittler and L. Jesser, Mineralogical Institute of Vienna University; and Thermo-chemical Researches on Cement Raw Meal and on Cement, by Prof. Dr. R. Nacken, University of Frankfurt.

A short statement of the results of the work described in Appendix 1, is given at the conclusion as follows:

1. Cement formation is attended by an important evolution of heat, the heat value of the reaction per 1 gram calcium carbonate becoming smaller as the amount of the basic constituents of the raw material increases.

2. For cement of the usual composition resulting from a raw material containing about 75% calcium carbonate the value of this exothermic reaction is 115 to 118 gram calories per 1 gram calcium carbonate in the raw material. We calculate from this that the total heat of formation of cement under works conditions, (i. e. under constant pressure) is +115—435=—320 gram calories per 1 gram calcium carbonate in the raw mixture, this being the sum of the exothermic reaction and the heat of dissociation of calcium carbonate.

A Handy Shaft Hanger Kink

By W. F. Schaphorst

All millwrights agree that it is bad practice to run a large belt onto a pulley by first forcing one of the edges to catch and then running the belt on either by hand or by power. It is well known that this is liable to cause the belt to stretch more on one side than on the other. The belt is thereby permanently injured. This holds true for belts of all kinds.

To avoid this condition we are often glibly told to make leather belts endless while they are on the pulleys by means of belt clamps, etc., but that method may not always be practical and sometimes it is impossible, particularly if the belt has already been made endless by the manufacturers as is often the case.

Where conditions allow it a good kink for putting large belts onto the pulleys so as not to injure them is to loosen the adjusting screws on the hangers as shown in the sketch herewith. This permits the shaft to move over a considerable distance, temporarily shortening the distance between shaft centers. Sometimes the shaft may be moved inward 2 in. or even more, thus making it possible to put the belt on easily. Shortening the center distance 2 in. virtually adds 4 in. to the belt's length. Also, to further assist, one of the hanger bolts for bolting the hanger to the overhead beam may be loosened so as to allow the hanger to swing inward still more. Where patented overhead beams are employed it is sometimes possible to slide the entire hanger forward without touching the adjusting screws. All of these methods are possible, yet they are seldom used because they are not thought of. The writer has never seen one of them mentioned in print in any magazine or book.

Then, after the belt is on the pulleys, bring the hanger back to its normal position. This is a simple thing to do by turning the nuts where the first and second methods mentioned above are employed. The original position of the hanger should always be marked before moving to avoid tedious realigning. Turn the bearing adjusting screws back to their original positions. These positions are easily found because the screw on the opposite side and the top screw need not be moved at all as indicated in the sketch.

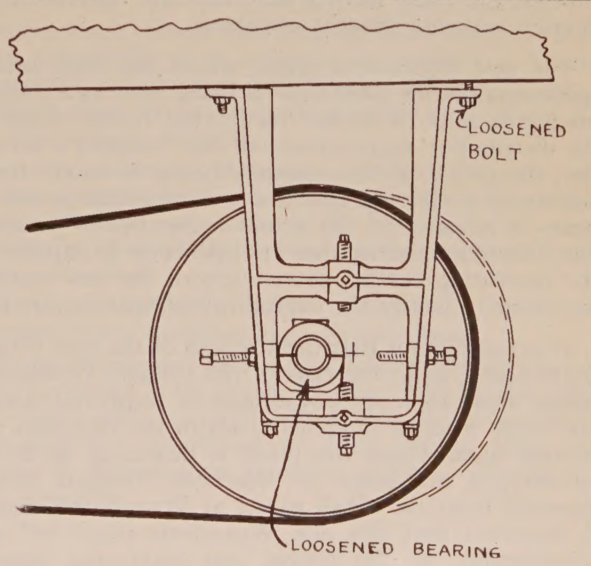

Fig. 1—Sketch Showing Method of Adjusting Pulley to Allow Putting on Belt

In the sketch, which is drawn slightly exaggerated to emphasize these points, the cross lines indicate where the center of the shaft will be after the beam bolt is retightened and after the adjusting screws are back to their original positions. The dotted curved lines show where the pulley rim will be after everything is retightened and back to normal.

To be sure this method is not always practical where there are belts running in both directions as on a common line shaft, but where it can be employed it is well worth while. It is a quick and simple method and the saving effected in large expensive belts surely makes it worth remembering and putting into practice.

Hale Smith, secretary to Governor Sweet of Colorado, attended a prison labor conference at Salt Lake City, Utah, attended by eight western states, and it is reported that Smith advocated that Colorado prisons go into the making of cement, asking the other states represented to send in their orders to Colorado for the commodity.

Shortly after his inauguration, Governor Sweet advocated the making of cement at the Canon City penitentiary.

Huron Company Building New Plant at Wyandotte

That the construction of a new cement plant at Wyandotte, Mich., to be operated in addition to the present facilities has been started, is announced by the Huron Portland Cement Co., of Detroit, Mich. The production capacity of the new plant will be 20,000 sacks daily, and the plant, which will represent the last word in modern efficient cement plant design, will be completed ready to operate January 1, next.

In addition to its present facilities for serving the construction industry in Detroit, the Huron Portland Cement Co. also operates the Wyandotte cement plant in conjunction with the Michigan Alkali Co., at Wyandotte. The Wyandotte plant, the output of which is 2,000,000 sacks annually, has been in operation for a number of years. The Huron company has just completed an important construction program at Alpena, the plant having been enlarged and the production capacity greatly increased.

The new Wyandotte plant, which has been under contemplation for some time, is being built as a reserve producing unit to further fortify the future needs of the distributive requirements of the company's activities, the policy of the company being to create these additional producing facilities a substantial period of years in advance of the actual necessities of present-day demands, placing them in operation as rapidly as the marketing conditions can absorb the new output and thereby justify the capital investment required.

It is pointed out that the strength of the new Wyandotte plant, as in the case of the present Wyandotte plant, aside from its advantages of improved design and more modern equipment, lies in the fact that the process upon which the plant is dedicated is, in its entirety, a utilization of otherwise absolute waste material from the alkali works at Wyandotte, and it is predicted that this new Wyandotte plant will unquestionably be the lowest cost producing cement plant in the world.

The ownership and management of the Huron Portland Cement Co. and the Wyandotte Co. is entirely local, the personnel of its officers including the following: John B. Ford, president; E. L. Ford, vice president; John W. Boardman, vice president; S. T. Crapo, secretary-treasurer.

Anti-Dumping Act Urged

A large attendance of domestic cement manufacturers was expected to be present in Washington on June 6 at a hearing before Assistant Secretary of the Treasury Moss on their request for application of the anti-dumping act to imports of cement, according to the *New York Commercial.*

It is stated that every manufacturer in the country has been invited to be present at the proceeding and to present arguments in behalf of the application. The American manufacturers, it is cited, maintain that their industry has been seriously injured by floods of imports of cement from Norway, Sweden, and Belgium, and that this product is being dumped in the United States at less than its market value in the countries of origin.

National Lime Association Holds Important Convention

The National Lime Association this year made a radical change in the holding of its convention, taking it to White Sulphur Springs among the picturesque mountains of West Virginia, where a part of the time could be devoted to outdoor sports and social features. And in spite of the fact that the business of the association was confined to one session a day, a belief was freely expressed that this convention has to its credit the best record of accomplishment of any so far held.

The technical program was devoted very largely to the uses of lime rather than to manufacturing or business problems, though in the larger sense the extension of the uses of lime is the biggest business problem now before the manufacturers. It is only within a comparatively short time that these producers have become aroused to the possibilities of such extension; yet now a program is in progress which embraces a wide range of investigation, providing several fellowships at American universities and using the services of about 30 men outside of the industry itself. The University of Wisconsin, for instance, is working on the problem of the value of fractional rates of soil liming; the University of Nebraska is to determine the effect of liming materials on the physical structure of soils; the University of Missouri is investigating the effect of lime in dirt roads; the University of Ohio is making a complete survey of the use of lime in the treatment of trade wastes.

Other newer and more uncommon uses are being developed, such as its use in whipping cream, the dusting of molds, as a catalyst in the manufacture of organic compounds, and in the manufacture of acetone, benzoic acid, methol, etc. As a result of some of this work, it is believed that final figures on the industry for 1923 will show an increase in chemical uses of 12% over previous year.

Experiments of Dr. W. H. McIntyre at the University of Tennessee undertaken primarily as agricultural research, have developed facts and data in regard to reactions among lime, aluminum, iron, sulfur, and silica which may have very important bearing on the chemistry of cement, lime, and plasters of all kinds.

From a construction standpoint, attention was devoted specifically to the lime plaster investigations and the lime building block, as well as the use of hydrated lime in concrete as exemplified in such work as that now in progress at Muscle Shoals.

Building partition blocks were on exhibition as manufactured at the experimental plant at York, Pa., and tests so far made show them to attain their strength in a remarkably short time. Not such rapid progress has been made on the development of a quick-setting wall plaster, but good progress was reported.

The principal production problem discussed at the sessions was in regard to the discovery of stone by underground mining instead of the open quarry method. Representatives were present of two large concerns who are mining their stone and consider the method more satisfactory in many respects.

The outing features of the program included golf, tennis and quoits tournaments, and a dinner and entertainment at a mountain cabin.

Cement ranks as the third largest industry in the Birmingham, Ala., district according to S. H. MacArthur, field engineer of the Portland Cement Association.

Air Compressor Cylinder Lubrication

Under the heading "Air Compressor Cylinder Lubrication," it is explained in *Lubrication*, a technical publication devoted to selection and use of lubricants and published by the Texas Co., New York City, that relatively few machines will involve, as does the air compressor, the combined possibility of not only a cessation of operation, but also the possibility of explosion in event of:

1. Improper selection of the air cylinder lubricant.
2. Excessive feeding of the lubricant.
3. Oil pockets occurring in the system, due to improper design.
4. The absence of an after cooler (by which oil accumulations and dirt can be removed).
5. Discharge piping being too small or congested to be able to handle the requisite volume of air without the necessity for a decided increase in its velocity, and consequently its temperature.
6. The occurrence of air leaks on account of inefficient delivery valves.
7. The continued compression of air which is not free from dirt. The air intake should therefore, be so located as to secure clean, cold air, or a suitable air filter should be used.

Conclusion

We are therefore faced primarily with the problem of eliminating, as far as possible, the likelihood of air compressor explosions. This becomes a relatively simple matter if we remember that efficient operation is brought about by:

1. *Using Clean Cold Air*—to keep temperatures down and prevent dust and dirt from entering the system. If this cannot be obtained naturally, use an air cleaner or filter.
2. *The Use of Cold Water*—to insure as low a cylinder temperature as possible.
3. *The Use of Soft Water*—to prevent scaling of cooling water ackets.
4. *Periodic Inspection of Valves etc.*—to note extent of lubrication, and whether carbon formation is occurring.
5. *Cleaning of Air Cylinders About Once a Week*—using a soft soap wash (feeding same into system instead of lubricating oil for several hours) in order to remove carbon formations. Air lines to receiver should be thoroughly blown out after each wash.
6. *Periodic Inspection of Cooling Water Jackets*—to note extent of scale formation. Also cleaning if necessary.
7. *Installing an Aftercooler*—to cool and condense oil so that it can be properly drained from the system.
8. *Installing a Receiver*—to equalize air pressures.
9. *Using Good Oil*, and just enough of it to lubricate the air cylinders properly. Judge this by the condition of your valves and cylinder walls.

Classification of Portland Cement

By R. Rison Schlyter

Extract from the Swedish publication *Teknisk Tidskrift*, Stockholm, translated by E. Lee Heidenreich.

The question of classification of portland cement is comparatively new. Some results of both experience and scientific investigations are available, but not sufficient for final conclusions.

The government testing laboratories have prepared a report on the qualitative development of the cement production, which also refers to the French ciment fondu or alcement, and R. V. Frost, department chief engineer of the testing laboratories, suggests a classification of cements similar to that of iron or steel.

Based on this report, the concrete association has prepared a preliminary outline of classification of portland cements.

The technical development of cement has demonstrated that, for instance, a cement may be produced which both shows a rapidly gained strength and a hitherto unusually high final strength.

The production of the French ciment fondu has incited our cement manufacturers to produce a portland cement which is, if possible, equally quick hardening (not to be confounded with "quick setting") as the French cement, and have succeeded so far in producing a cement which already after 2 days gives the compressive strength required in 28 days, and after 28 days shows a strength over twice that normally required.

Among the advantages gained in the use of this kind of special cements are, reduction of the time of construction, saving in the cost of forms, smaller dimensions, reduced cost of heating in cold weather, and reduced quantities of cement.

These advantages are, however, reduced by the greater cost of the special cement.

A rational classification demands collaboration between the interested parties in and for the formation of technical economical commissions, to compare notes as to the methods of application, required quantity of production, consumption and costs, and the influence of the several new qualifications on the concrete.

So far, both cement and concrete have been investigated principally as to compressive strength and not so carefully as to tension and shear as well as shrinkage, although these stresses are not necessarily a function of the compressive strength.

Tension, shear and shrinkage are, however, often of decided importance in reinforced concrete with reference to formation of cracks or the rusting of the reinforcements, all of which tend to determines the life of the construction.

In the standards for special cements and concrete, therefore, these qualities must be considered.

As the commission for concrete bridges might include special cements in its report, it is to be hoped that the few experiments required will enable the revision of standards for cement and concrete due in 1926, to present a classification including special cements of high strength.

New English Cement on the Market

A new special brand portland cement, claimed to be quick hardening and to have immensely high ultimate strength, has been announced by Bruce Doan & Co., London, England. It is claimed for this cement that it is a genuine artificial portland cement, corresponding in every respect physically and chemically to the British Standard Specifications, whose requirements, however, are greatly exceeded. It is announced that this cement is the outcome of scientific research work and practical experiments extending over a number of years, made with a large number of different raw materials. Various methods of manufacture and various temperatures were tried in order to obtain a cement which would surpass in strength and soundness anything at present on the market.

Various unique properties are claimed for this cement, including a very rapid growth in strength, immensely high ultimate tensile and compressive strength, extremely close bond of union between concrete and reinforcement, extreme water tightness, and resistance against climatic influences and the action of sea water. The price, it is claimed, is only slightly higher than that of any ordinary first class artificial portland cement, and much lower than that of other kinds of cement for which similar advantages are claimed as those possessed by this special brand of portland cement.

Mining Limestone for Lime Manufacture

By Oliver Bowles

Superintendent, Nonmetallic Minerals Station, Bureau of Mines, Department of the Interior. In Cooperation with Rutgers College,
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Reports of investigations, Department of the Interior—Bureau of Mines.

In its broader sense the term "mining" is applied to all processes whereby raw materials are taken from the earth to be used as sources of mineral products. In a more restricted sense, "mining" is applied to underground operations, as contrasted with open pit work, designated as quarrying. The term is used in the restricted sense in this paper, for it relates to the exploitation of limestone deposits by modern methods of underground operation rather than by open pit methods.

Present Tendency Toward Mining

It may seem to some readers that a paper on mining limestone will find little general interest among lime plant operators, for only a limited number of them have yet resorted to this means of procuring raw materials. It is noteworthy, however, that a growing tendency exists toward underground operation, for, one by one, quarry owners are faced with increasing difficulties in open pit operation. It seems desirable, therefore, for operators to keep closely in touch with this gradual change in process, to inquire into the underlying causes, to compare costs, and to study the effects of the change in method on subsequent steps in calcining the stone to produce lime.

Conditions Encouraging Underground Work

The most important factor encouraging mining methods, in some places even forcing operators to underground work, is the presence of a heavy overburden. Conditions may be such that with enlargement of the quarry a heavier overburden is continually encountered. Where strata dip at an angle, the tendency is to quarry on the outcrop of the desirable beds, thus extending the pit in the strike direction. If through the limitation of property lines, or for any other reason, it is impossible or inadvisable to extend the quarry further along the direction of strike, or, in other words, along the line of the rock outcrop, the pit must be extended laterally. In one lateral direction the beds run out at the surface, and, in the other direction, with each advance an increasing depth of overburden must be encountered. This is illustrated in Fig. 1. If *w*, *x*, *y*, *z* are the desirable beds, and extension in the strike direction *a* is not permissible, it becomes necessary to extend the pit in the direction *b*. It is evident that with enlargement in this direction, the overburden *o* increases greatly with each advance, and would soon become so heavy that profitable open pit work would be impossible. When this point is reached, underground methods become imperative.

Difficulty of stripping, owing to the presence of clay pockets and seams in the upper ledges, may also encourage operators to mine the stone. Where such conditions prevail, not only is the stripping process slow and costly, but it is difficult to separate sand, gravel or clay from the good stone. Where a mining method is followed, little or no foreign material is intermixed, for operations are usually conducted exclusively on the solid ledges of good stone.

The purity of the product obtained in mines, as compared with that produced in many open pit workings, has a very important bearing on use. Many lime plant operators supply stone to the fluxing market, where there is a strong objection to the presence of fines. The open hearth operator's objection is chiefly on the basis of impurity, for any siliceous material, such as clay or sand, associated with the rock is segregated with the fines. For blast furnace flux, draft retardation is one objection to fines, but impurity of the fines is also an important basis for rejection. Thus objection to the smaller sizes is due not so much to the inability of the furnace men to use fines, as to the fact that through many years of experience, furnace men have found that fine materials almost invariably contain an excess of silica. Where the operation is conducted underground, and no clay seams or pockets are encountered, the fines are as pure as the lump stone. When flux stone users are convinced of this fact, it is probable that a much wider market will be found for the smaller sizes of stone produced in mines. One lime producer, who also sells fluxing stone, obtained from his mine, lately informed the writer that no objection is raised to considerable quantities of fine materials in his product, because the fines analyze as low in silica as the one-man stone.

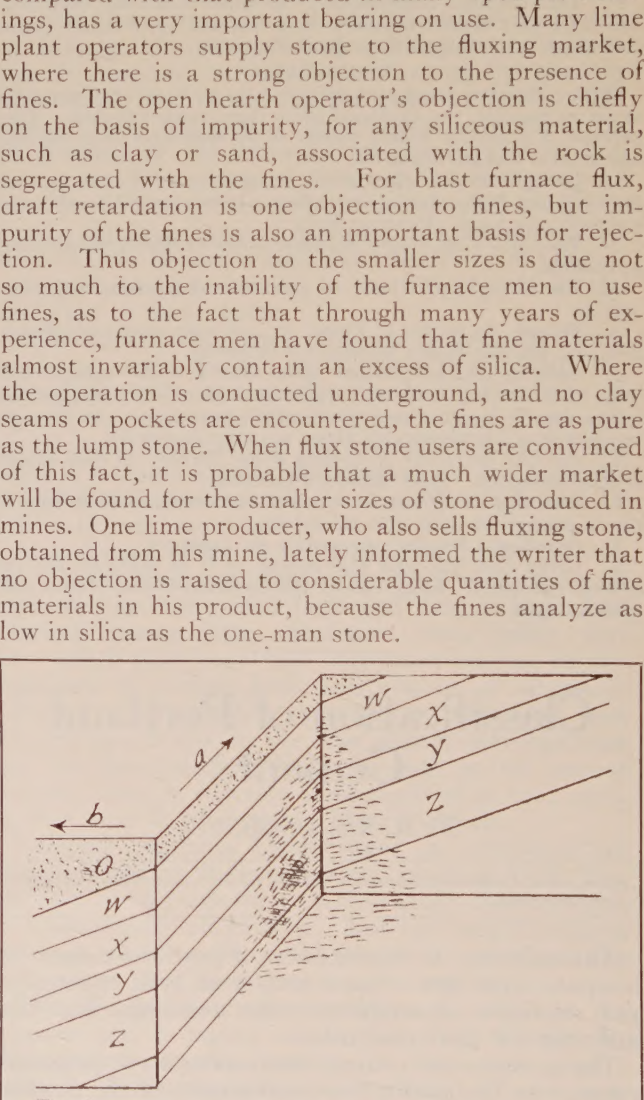

Fig. 1

The absence of contamination from surface impurities is reflected also in the high quality of the lime produced. Where open pits are operated in rainy weather, adhering clay tends to lower the grade of the lime produced, while in the mine the rock is exposed neither to the rain nor to the surface debris.

At many quarries, difficulty is experienced in finding a suitable disposal area on which to dump the stripped material. Property lines may be restricted, or the land may be too valuable to use for such a non-productive purpose. This is another factor that may influence the owner to avoid the stripping operation by employing underground methods.

With the quantity production demanded by large consuming industries, imestone quarries are rapidly becoming larger. Where the desirable stone is in flat-lying beds of limited thickness, extension takes place laterally. Even in some thick deposits, wide and comparatively shallow workings may be preferred, if a large area is available and overburden is thin. Where the surface area is restricted, as in tilted beds, the quarryman may be obliged to work at great depths. The difficulties and dangers of working at depths of several hundred feet, and the resulting increased cost of production, is an influence that tends toward mining methods.

Another advantage of mining is the protection it affords to workmen from cold and rainy weather. In open quarries, much time is lost through bad weather, particularly in northern localities. Snow and ice impede operations and render them more hazardous. Where clay is mixed with the rock, rain prevents a clean separation. Where the underground method is followed, the workman is quite independent of weather conditions, his activities are not impeded by ice, snow or rain, and his product is not impaired by their influence.

Disadvantages of Mining

Mining methods require the use of small drills on comparatively low benches. The modern tendency in quarrying is to throw down great quantities of rock at one time with heavy blasts in deep churn drill holes. Generally speaking, this results in more economical quarrying than the method of employing smaller drills on a series of low benches. The big-hole blasting method cannot be used underground, and thus the limestone miner is deprived of any advantage that might result from its use. Also, the working face in a mine is usually much more restricted in area than the face of an open pit, operations more crowded and efficiency reduced. Thus the actual cost of drilling and blasting is in general higher in underground than in open pit work, but this is offset in some measure by the production of cleaner rock and by elimination of a stripping expense.

Where blasting is conducted in confined spaces, the products of combustion constitute a hazard with which the open pit operator does not contend. Blasting should take place at the end of a shift, but this is not always possible. In some mines, a drift is left unoccupied for an hour or two immediately after a blast, the workmen being employed elsewhere. Removal of impure gases may be hastened by allowing air to escape from the compressed air lines at the extremity of the drift. In extensive underground development, the condition of the air will be improved and the removal of gases will be facilitated by the use of mechanical ventilation equipment such as fans, brattice curtains, or tubes.

Another disadvantage is the vigilance required to avoid accident from roof falls. With sound limestone it is comparatively easy to keep the roof safe, though with jointed stone, or stone inclined to spall easily, constant care is required. If proper pillar support is maintained, it is probable that the hazard is no greater than in deep open pit quarries, where a like danger exists from falls of rock from the quarry face or over the edge of the pit.

A very important disadvantage of underground operation to the lime producer is the increased proportion of small-sized stone. Where a ledge with a free upper surface is blasted in a drift or chamber, it is possible that the proportion of fines may be no greater than in open pit work, but in driving headings in solid rock with only one free face, heavy blasting is required, and the proportion of fines is usually high. As pointed out in a previous paper,[1] a better utilization of the smaller sizes of limestone is one of the outstanding problems at lime plants. The tendency of underground work to increase the proportion of fines further complicates this problem and renders a satisfactory solution more imperative. It is, however, important to emphasize the statement made in a previous paragraph, that the fine materials obtained in mines are, as a rule, much purer than those obtained from open pits, and therefore they should be more easily marketed.

Influence of Rock Structures on Mining

A condition of first importance for successful mining is a sound rock that will provide a strong roof with little danger of spalling. Limestone is too low-priced a product to justify the expense of mine timbering, except possibly in main entries or hoist shafts, and no mine can be operated successfully where the rock has insufficient strength to provide a safe roof for drifts or chambers at least 25 or 30 ft. wide. Great care must be exercised in mining jointed rock, for the joints may permit masses to fall from the roof. Where inclined joints meet a tunnel roof, there is a tendency for triangular fragments to break loose and fall. Horizontal joints, if closely spaced, constitute a danger from roof falls, but where spaced at intervals of several feet, they sometimes greatly facilitate mining. If an open seam may be utilized as a plane of separation at the top of a drift, it provides a smooth and safe roof, and makes blasting cheaper than in solid, unjointed rock. Similarly, a bottom seam provides an easy plane of separation at the floor, thus reducing drilling expense and conserving explosives. It is clear, therefore, that the jointing of the rock has an important bearing both on the cost of mining and on safety.

Where limestone beds are inclined, mining is more difficult than where the strata are horizontal. The entries commonly follow the dip, while the drifts parallel the strike. Thus operation in the drifts may be conducted on level floors, with inclined haulage in the entry.

Examples of Limestone Mines

In the following paragraphs, limestone mines that have been visited by the writer are briefly described. These descriptions illustrate the types of mines now, or recently, in operation, and the general mining methods pursued, but no attempt is made to describe methods in detail at this time.

American Lime & Stone Co., Bellefonte, Pa.

One of the most remarkable underground operations in limestone is the mine of the American Lime & Stone Co., at Bellefonte. The high-grade limestone is in a bed 77 ft. thick, dipping 52° at the surface. An 8- x 24-ft. shaft was sunk 90 ft. back of the footwall, at an inclination corresponding with the limestone, 52° at the surface, changing to 63° between the second and third levels. The shaft is 390 ft. deep on the incline. Four horizontal crosscuts 7½ x 24 ft. extend from the shaft into the good stone, the first 65 ft. below the surface and the others at intervals of 60 ft. Just below the fourth level is a loading pocket of 250 tons capacity, from which the stone is hoisted to the surface in 5-ton skips. The stone is worked out from chambers by an overhead shrinkage stopping method. The rock is drilled and blasted down from the roof, sufficient broken rock being removed to maintain a working space between the accumulation of broken stone and the roof. When the stone or chamber is completed, all the broken rock is withdrawn. Pillars of limestone are left for roof support.

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[1] *Utilization of Waste Rock at Lime Plants*, Reports of investigations, Serial No. 2463.

Alpha Portland Cement Co., Ironton, O.

The Ironton mine is unique in limestone mining, as it consists of a 560-ft. vertical shaft with numerous drifts and tunnels. A supplementary air shaft is provided. The bed of good stone is about 30 ft. thick and practically horizontal. The stone is removed from drifts and cross cuts, leaving 20-ft. square pillars for roof support. At the time of the writer's visit, several years ago, a rotary electric drill was used successfully. Originally hand loading was employed, but during recent years, car-loading machines have been used. The introduction of electric shovels is now contemplated. Mules are employed to collect cars into trains, which are hauled to the main shaft with an electric locomotive. The stone is used for the manufacture of portland cement.

Alpha Portland Cement Co., Manheim, W. Va.

Mining operations are conducted at Manheim in a 26-ft. bed of limestone, dipping about 17°. When visited in 1916, this mine consisted of 10 parallel drifts each 45 ft. wide, with numerous cross cuts. The supporting pillars are 30 ft. square. The roof is very strong, consisting of a massive 20-ft. bed of limestone. A portable derrick is used for roof and wall cleaning. The main drifts are nearly parallel with the strike, but run at a small angle up the dip, thus providing automatic drainage and easy transportation of rock. A 14-ft. pioneer bench is first driven at the roof, and the remaining 12-ft. bench is broken by blasts in vertical drill holes 6 ft. apart. An open floor seam makes easy blasting on the second bench. Loading is accomplished with electric shovels. Gasoline locomotives are used for gathering cars, while transportation through the main entry to the top of the incline is furnished by an electric locomotive. The rock is conveyed down a long and steep incline to the plant, where it is used for portland cement manufacture.

Atlas Portland Cement Co., Hannibal, Mo.

An underground method was employed at Hannibal some years ago, but was later abandoned, as it was felt that the costs were too high. The rock lies in nearly level beds. Several drifts were driven in the hillside, about 45 ft. wide and 30 ft. high, with 20-ft. pillars between them for roof support. A pioneer bench was driven at the roof, and the remainder of the face removed as a single bench by blasts in vertical drill holes. A shale bed provided easy floor separation. The rock was hand loaded and removed in carts.

Calcium Products Co., Hollidaysburg, Pa.

The Calcium Products Co. operates a mine in a 30-ft. bed of high-grade limestone, dipping about 12°. The bed outcrops on a hillside, and thus the entry to the mine permits level or slightly downhill transportation of rock. The entry branches to provide three drift faces, the deepest of which is 320 ft. from the outcrop. The drifts are 30 ft. wide and 33 ft. high. A 3-ft. shale bed lying above the limestone is removed as waste, as it is insecure, but when removed, a very smooth and safe roof is obtained. Pillars 30 ft. square are left for roof support. Drilling on the higher parts of the drift faces is done from a 3- x 3-ft. cage on the end of a 40-ft. boom mounted on a car truck. This boom may be raised, lowered or moved laterally to any desired position. Jack hammer drills are used for horizontal or inclined holes. Hand loading is now employed, but the introduction of some power loading device is planned.

Low Moore Iron Co., Low Moore, Va.

The Low Moore Iron Co., mine is operated in a limestone bed 40 to 60 ft. thick, and varying in dip from horizontal to a dip of about 15°. The entry is an inclined shaft 123 ft. long on an incline of 30°. A sandstone bed affords a strong and massive roof, so that drifts and chambers may be worked to a width of 50 or 60 ft. In places, however, the roof is weakened by erosion cavities. A regular room and pillar system is followed, except where modified by the presence of caves. In developing the drift faces, a 6-ft. heading is first advanced at the roof by shooting out successive series of V-shaped "locks." The remainder of the face is worked in a series of 10-ft. benches broken out by blasts in vertical holes, supplemented by lift holes in the bottom bench. When visited in 1917, the rock was loaded with a compressed air revolving shovel into 5-ton steel drop-bottom cars, conveyed by gravity to the bin, and the empties returned by gasoline locomotive. From the loading bin the limestone was hoisted to the rock house by means of 2-ton steel self-dumping skips. The rock is used for blast furnace flux.

Marquette Cement Manufacturing Co., Oglesby, Ill.

Extensive underground workings are operated on three 7-ft. beds of limestone, giving a drift height of 21 ft. A regular room and pillar method is followed. To give efficient roof support, the pillars are staggered so that rooms on one side of the main entry are opposite the pillars on the other side. The drifts vary from 20 to 40 ft. in width, depending on the security of the roof. The middle 7-ft. bench is advanced first, as a clay seam affords easy separation from the lower bed. The rock is loaded with power shovels, and hauled by electric locomotives. A coal mine beneath the limestone has caused much difficulty through subsidence of the limestone floor. By good engineering, the difficulty was met, and continued subsidence was prevented by permanent enjoinment of the coal company against further operation.

Missouri Portland Cement Co., Sugar Creek, Mo.

The operation at Sugar Creek is a drift mine with a horizontal entry in a hill side. The drifts are 35 ft. high and 40 to 50 ft. wide. At the roof there is a thin bed of limestone 1 ft. thick, separated from the massive bed above by a thin band of shale. At first, this bed was left at the roof, but it was found to be insecure on account of the easy parting in the shale band, and later it was entirely removed, leaving a very strong and safe roof. In advancing the face, a pioneer bench 8 ft. high is first driven at the roof, and thereafter three successive benches of 8, 9 and 10 ft. are removed by blasts in vertical drill holes. Loading is done with two tractor air shovels. Production is 600 to 800 tons per day. In 1923, the total length of tunnels in this mine was approximately 4 miles. The rock is used for portland cement manufacture.

Wellston Iron Furnace Co., Superior, Ohio

The high-grade limestone bed at Superior is 8 ft. thick, nearly level, and outcrops on a steep side hill. The rock is removed through a long horizontal entry with numerous lateral drifts. A heavy sandstone bed provides a strong and safe roof. An 8-in. bed of soft blue shale beneath the limestone greatly facilitates rock removal, for the limestone is undercut by means of a coal-cutting machine operated in the shale. When undercut, the limestone is easily blasted down. The rock is hand loaded, and the cars hauled by electric trolley locomotives. It is used for portland cement manufacture.

Other Limestone Mines

Several other limestone mines, some of them well developed and of wide extent, are now operated in various parts of the United States, but no descriptions of them are available for publication at this time.

Summary

The outstanding features of limestone mining are as follows:

1. Quarry conditions are gradually forcing a more general adoption of underground methods.

2. Limestone is too low-priced a product to justify the expense of mine timbering except possibly in shafts or entries, and hence successful mining can be conducted only where the rock is sufficiently strong and massive to permit the maintenance of safe roofs in drifts and chambers with supporting pillars spaced not less than 25 or 30 ft. apart.

3. In general the proportion of fines is higher in underground than in open pit work, and this condition further complicates the already serious problem of finding profitable use for small sized stone. However, the fine materials produced in mines are purer and thus more marketable than the fines from quarries.

4. The cost of drilling and blasting is usually higher where underground methods are followed, but on the other hand, a cleaner rock is produced with no stripping cost, and the work is subject to no delay from the weather.

Power Plant Management[1]

By Robert June
Assoc. Mem. A. S. M. E.

What Management Should Know About Coal

The proper selection of coal, the adaption of the right fuel to the right equipment is a problem, the correct solution of which offers unusual opportunities to effect economies in the operation of the power plant. It is a problem which should ever be taken into consideration in the design of a proposed plant.

Classification of Coals

The distinctions between the various ranks of coal are not clearly defined. The most satisfactory method for establishing the various classifications is by the use of both mechanical and physical criteria. On this basis the ranks indicated below are arrived at.

Anthracite. The outstanding characteristic of anthracite is its low volatile content. Because of this it burns with very little flame, giving an intense fire free from smoke. Good anthracite is hard, compact, and lustrous, giving a vitreous fracture when broken. The chemical composition and heat value of anthracite is shown in both Fig. 1 and Table I.

An important source of financial loss in the use of anthracite lies in the fact that no matter how carefully handled, it is liable to break up into very tiny pieces under the influence of the high temperature of the furnace, when freshly fired, with consequent large losses of fuel through the grates to the ash pit. As anthracite requires at least 40% greater combustion space than does bituminous coal, it should never be purchased for use in furnaces not designed for it.

Semi-Anthracite. This coal reaches the consumer generally under the name of "Anthracite," a deception which should not be tolerated. As the name implies it is inferior to anthracite. It has less fixed carbon and somewhat more volatile. Its characteristics are likewise given in Fig. 1 and Table I.

Super-Bituminous. This grade of fuel is commonly termed "Semi-Bituminous"—an unfortunate appellation as it creates the inference that this coal is inferior to bituminous whereas it is markedly superior.

Another trade name for this fuel is "smokeless" coal. The latter term is a consequence of the relatively high percentage of fixed carbon which renders the coal practically smokeless when properly burned. The heat value of this fuel is very high and as it requires less bunker and storage space per unit of heat than other coals, it is in great demand for naval and steamship use, as well as for manufacturing plants located in crowded quarters where storage space is at a premium and smoke regulations are enforced.

Super-Bituminous coal possesses one characteristic which the public has been prone to regard as a rather serious disadvantage; that is the coal is quite friable, readily breaking into small pieces not only during the process of mining, but also in transportation and handling. This apparent disadvantage is not necessarily existent as the coal can be burned with practically no loss through the grates to the ash pit, when fired with mechanical stokers and grates adapted to the fuel. Reference again is made to Fig. 1 and Table I for outstanding characteristics.

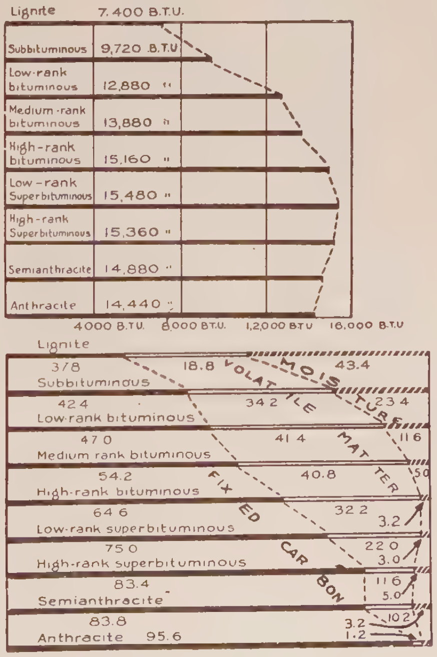

Fig. 1—Approximate analyses of various coals

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[1] Copyrighted 1923 by Robert June.

Bituminous. This term is applied to a wide variety of fuels. The classification "bituminous" is based in particular upon the relation of volatile matter in the coal to fixed carbon, but also and more especially to the factor which distinguishes bituminous coals from those of lower rank. This factor is that true bituminous coal is only slightly affected mechanically by weathering even though it be exposed for a long period of years. This is not true of coals of lower rank, which break up readily under the influence of weather.

Many attempts have been made to divide bituminous coals up into characteristic groups. This is not readily accomplished but the following classifications tell the power plant operator what he ought to know.

(a) *Non-Coking,* dry bituminous coals are the best for steaming purposes. They closely approach Super-Bituminous in character, being hard and dense, but inclined to be friable, breaking easily in transportation and handling. They ignite readily, and burn freely with a short, clean, bluish flame.

(b) *Bituminous Coking Coals* as their name implies swell up, becoming pasty and fuse together in burning. They have a higher percentage of volatile and less fixed carbon than the free burning non-coking coals. Being rich in hydrocarbon these coals are particularly adapted to gas making. Certain varieties are commonly sold as "gas coal."

(c) *Long Flaming Bituminous Coals* are notable smoke producers. Some varieties coke, others do not, so in using coal of this grade for steam purposes care should be taken to secure a supply at all times from the same source; otherwise uncertain combustion conditions will prevail and financial loss ensue. As a general proposition this coal is preferable for use under dryers, in cement kilns, etc. rather than for general steam making purposes. Where choice may be exercised, the non-coking, free burning, bituminous coals of the West Virginia, Pittsburgh and Illinois Districts are to be selected for the production of steam. Again we refer to Fig. 1 and Table I.

Sub-Bituminous. The distinction between this coal and bituminous lies in the fact that Sub-Bituminous rapidly loses its moisture and consequently slaeks to a marked extent when subjected to alternate wetting and drying. As the matters of both size and moisture content are important in buying and shipping coal, there are a number of points to be considered before voluntarily adopting sub-bituminous coal for use in the power plant. For one thing, unless slaking is to be permitted, it is almost necessary to ship sub-bituminous coal in box cars, thus materially increasing the cost of loading and unloading. Another point is that sub-bituminous coal is extremely liable to spontaneous combustion. On the other hand sub-bituminous is a very clean fuel and ignites with little difficulty.

Lignite. As used by the Geological Survey the term "lignite" is restricted to those coals which are distinctly brown in color and either characteristically woody or clay—like in their appearance. Because of their high moisture content which may run up to 30 or 40%, these coals cannot be shipped far as no one wants to pay freight on so much water. Lignites are even more difficult than sub-bituminous coals to handle because of their rapid loss of moisture and marked tendency to slake and to spontaneous combustion. For economical steam generation Lignite should be purchased near the power plant and practically used as rapidly as received.

COMPARISON OF DIFFERENT RANKS

Fig. 1* shows approximate analysis of B.t.u. value of the various ranks of coal. This diagram is based on the properties of actual samples of commercial fuels in each rank. Fairly regular increase in fixed carbon from lignite to anthracite will be noted. The rapid increase in the moisture in the lower ranks of coal is of interest as is also the fact that the greatest amount of volatile matter is found in the lower ranks of bituminous.

The diagram at the right shows the B.t.u. value of the coals on an ash free basis. It will be seen that the best coal for steaming purposes is low rank super-bituminous and that lignite possesses very slight value indeed.

TABLE I

Location and Rank of Coal	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Heat Value B. t. u.
ALABAMA						
Lookout Mt., super-bitum.	3.8	19.0	64.4	12.8	1.5	12,980
Birmingham district, bitum., coking	2.4	25.9	66.8	4.9	1.5	14,490
ARKANSAS						
Russellville district, semi-anthracite	2.1	9.8	78.8	9.3	1.7	13,700
Paris district, super bitum.	2.8	14.7	73.4	9.1	2.8	13,770
CALIFORNIA						
Stone Canyon district, bitum.	7.0	46.7	40.1	6.2	4.2	12,450
Mt. Diablo district, sub-bitum.	15.0	38.4	34.5	12.1	5.6	9,240
COLORADO						
Denver field, sub bitum.	18.8	30.5	44.5	6.2	0.3	9,650
Trinidad field, bitum., noncoking	7.8	38.5	44.8	8.9	0.5	11,540
Newcastle field, bitum., coking	2.9	33.3	56.7	7.1	0.5	13,720
GEORGIA						
Manlo district, super-bitum.	2.9	17.1	72.2	7.8	0.7	14,200
ILLINOIS						
LaSalle Co., bitum.	13.9	37.3	38.5	10.3	3.4	10,990
Sangamon Co., bitum.	14.3	37.2	40.3	8.2	4.4	11,010
Gallatin Co., bitum.	3.4	35.2	52.5	8.9	2.9	13,190
INDIANA						
Knox Co., bitum.	10.6	38.1	43.0	8.3	3.7	11,750
IOWA						
Monroe Co., bitum.	15.8	36.9	37.9	9.4	4.7	12,900
KANSAS						
Crawford Co., bitum.	4.9	33.5	52.5	9.1	5.0	12,940
EASTERN KENTUCKY						
Bell Co., bitum.	2.8	37.8	56.3	3.1	1.0	14,240
WESTERN KENTUCKY						
Union Co., bitum.	3.9	37.1	49.7	9.3	3.5	12,830
MARYLAND						
Georges Creek basin, super-bitum., high rank	0.6	16.6	72.1	10.7	1.3	13,380
Lower Youghiogheny basin, bitum.	2.3	25.5	64.4	7.8	1.1	13,780
MICHIGAN						
Saginaw district, bitum.	11.9	31.5	49.8	16.8	1.2	11,780
MISSOURI						
Barton Co., bitum.	5.4	32.1	53.6	8.9	3.6	12,990
MONTANA						
Electric field, bitum., coking	4.0	22.5	59.3	14.2	0.6	12,760
Milloula field, lignite	24.7	29.3	26.1	19.9	0.9	6,730
NORTH DAKOTA						
Adams Co., lignite	32.4	30.9	28.1	8.6	1.5	7,330
OHIO						
Jefferson Co., bitum.	4.1	38.5	49.7	7.7	3.7	13,150
Washington Co., bitum.	3.4	38.7	49.1	9.6	5.0	12,750
OKLAHOMA						
Haskell Co., super-bitum.	2.7	21.1	69.9	6.3	0.8	14,100
OREGON						
Eden Ridge field, bitum.	12.6	35.0	37.7	14.7	1.3	10,350
PENNSYLVANIA						
Anthracite region, anthracite	2.8	1.2	88.2	7.8	0.9	13,300
Sullivan Co., semi-anthracite	3.4	9.3	75.6	11.7	0.8	13,120
Cambira Co., super-bitum., high rank	3.3	12.5	77.9	6.3	1.0	14,340
Westmoreland Co., bitum. coking	2.7	30.4	57.8	9.1	1.3	13,610
Allegheny Co., bitum.	3.7	34.0	56.8	5.5	1.4	13,870
Fayette Co., bitum., coking	2.8	30.0	59.8	7.4	1.2	13,990
TENNESSEE						
Claiborne and Campbell Cos., bitum.	3.6	37.3	55.5	3.6	1.1	13,980
TEXAS						
Houston Co., lignite	33.5	39.5	16.2	10.8	0.6	7,140
UTAH						
Carbon Co., bitum.	4.4	38.2	50.5	6.9	0.8	12,760
VIRGINIA						
Appalachian region:						
Tazewell Co., super-bitum.	3.8	15.5	77.8	2.9	0.6	14,860
Russell Co., bitum.	2.8	34.9	56.5	5.8	0.6	14,150
WASHINGTON						
Whatcom Co., anthracite	4.4	7.4	76.0	12.2	1.0	12,590
Black Diamond district, bitum.	6.8	40.0	47.9	5.3	1.4	12,330
WEST VIRGINIA						
Wheeling district, bitum.	4.1	36.6	53.3	6.0	2.1	13,400
Fairmount district, bitum.	2.9	34.5	56.9	5.7	0.7	14,040
Upper Potomac basin, super-bitum., high rank	1.1	17.2	73.8	7.9	1.1	14,490
New River district, super-bitum., low rank	3.5	22.2	71.9	2.4	0.7	14,690
Montgomery district, bitum.	2.4	35.5	56.7	5.4	1.0	14,160
Pocahontas field, super-bitum., low rank	3.4	22.5	68.8	5.3	0.5	14,370

GEOGRAPHICAL DISTRIBUTION OF COAL

Representative coals of each section of the United States are shown in Table I which is a compilation of analyses made by the United States Geological Survey and the Bureau of Mines.

MOISTURE IN COAL

Not only is moisture a non-combustible but it absorbs heat because it must be vaporized and dis-

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*Fig. 1 and Table I are based on data presented in *American Fuels* by Marius Campbell of the United States Geological Survey.

charged at stack temperature. Where the moisture percentage is small this is not such a serious matter, as 1% of moisture amounts to only one-tenth of one percent of 13,000 B.t.u. coal if we assume somewhat high stack temperature of 700°.

Another point with respect to moisture is important. The usual chemical analyses of coal do not show all of the moisture. The reason for this is that there is considerable amount of water which cannot be driven out of the coal even at 220° F. but remains in chemical combination usually as a carbohydrate which can only be driven off with volatile.

In a typical West Virginia coal, 13% of the volatile has been found to be water. In a typical Illinois coal 25% of the volatile itself is non-combustible in the form of water. The analyses of these two coals for which we are indebted to Mr. E. G. Bailey is given in Table II. This means that in making comparative appraisals of coals from different fields or in purchasing coal under specification the moisture content of the volatile as well as the free moisture should be taken into consideration to secure accurate results.

ASH

Ash is a complex compound consisting of iron, lime, alumina, magnesia, silica, titanium and various alkalies.

It is to be considered from two points. First, in buying coal with any appreciable percentage of ash in it you are paying not only the first cost but also freight and handling charges all through your plant for so much inert material. The second is of utmost importance. It concerns us with the fusing temperature of the ash and the actual temperature to which the ash is subjected in the furnace. There are coals, the ash of which has such a high fusing temperature, that there are practically no fuel bed conditions which will produce troublesome clinker. Next we find a different type of ash with a lower fusing temperature. This ash will clinker but in doing so it forms a porous spongy mass which does not materially obstruct the flow of air nor prove difficult to remove.

The really troublesome ash is that which has a low fusing temperature, say 2100° F. This forms the worst sort of clinker and the question of the use of coal which contains it should be given the most careful consideration by the power plant operator.

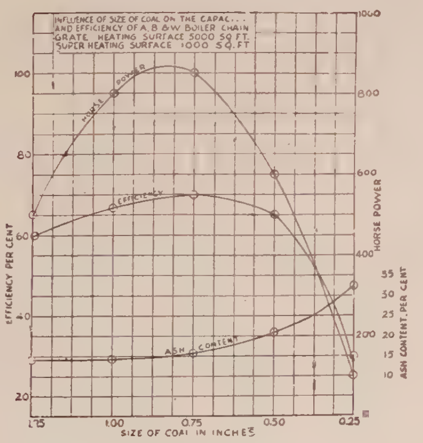


FIG. 2—DIAGRAM SHOWING INFLUENCE OF SIZE OF SCREENINGS ON BOILER EFFICIENCY AND CAPACITY

INFLUENCE OF SIZE ON BOILER EFFICIENCY

Bituminous coals are graded and sized as follows:

(a) Run-of-mine—unscreened coal which has been picked over only for removal of larger pieces of foreign material.

(b) Lump—Coal which will pass over a bar screen with 1¼ in. openings.

(c) Nut—Coal passing through bar-screen with 1¼ in. openings and over a screen with ¼ in. openings.

(d) Slack—Coal which passes through a bar-screen with ¼ in. openings.

Anthracite coal is graded and sized as follows:

(a) Run-of-mine—Unscreened coal from which larger pieces of foreign material only have been picked.

(b) Lump—Classed as 6-in, 3-in. than 1¾-in. according as the coal passes through circular openings of the larger diameter and over openings of the smaller diameter.

(c) Nut—Classed as follows:

Three-inch smaller than 5-in. and larger and 1¾ in. in diameter. One and a quarter inch—smaller than ¾ in. diameter and larger than ⅝ in.

(d) Screenings—Everything which passes through a 1¼ in. screen. This size of coal affects the draft of the furnace and influences the capacity of the boiler. Thus, the presence of large quantities of fine coal and dust will materially check the flow of air through the fuel bed. When fine coal is used thin fires are necessary, and this usually results in a decrease in boiler efficiency due to the presence of holes in the fire.

The percentage of ash in fuel generally increases materially as the size of the coal decreases. The explanation is that dust and small pieces of foreign material from the roof or floor of the mine, having been separated from the larger coal naturally find their way into the smaller coal. Fig. 2 illustrates the influence of the size of screenings on the capacity and efficiency of a 500 h. p. boiler fired by chain grate stokers.

The size of coal best suited to individual plant operating conditions should be determined by a series of tests. Once the most efficient size has been determined it will be found profitable to insist that all deliveries conform to this size.

TABLE II ANALYSIS OF A TYPICAL WEST VIRGINIA COAL

					Heating Value Per Pound	Calculated B.t.u.	B.t.u. by Calorimeter
		H	0.22				
Moisture.....	2.01			2.01 water......	None	......	
		O	1.79				
		H	4.86	5.38 water	None	......	
		O	4.78	4.26 available H.	62,000	2,641	
Volatile......	37.31	C	26.65	....	14,500	3,464	
		N	.23	....	None	.....	
		S	.79	....	4,050	32	
		C	49.18	....	14,500	7,131	
Fixed Carbon	41.80	N	1.20	....	None	.....	
		S	1.75	....	4,050	71	
Ash	8.55			..	None	......	.....
						13,339	13,811

ANALYSIS OF A TYPICAL ILLINOIS COAL

					Heating Value Per Pound	Calculated B.t.u.	B.t.u. by Calorimeter
		H	1.38				
Moisture.....	12.39			12.39 water......	None	......	
		O	11.01				
		H	4.47	9.01 water.....	None	......	
		O	8.01	3.47 available H.	62,000	2,150	
Volatile.....	36.89	C	23.19	....	14,500	3,363	
		N	.10	....	None	......	
		S	1.12	....	4,050	46	
		C	38.10	....	14,500	5,525	
Fixed Carbon	41.80	N	.90	....	None	......	
		S	2.80	....	4,050	113	
Ash..........	8.92			....	None	......	......
						11,197	11,399

TABLE III

Completeness of Combustion % of Undeveloped Heat	Rate of Combustion, Lbs. Per Sq. Ft. of Grate per Hour	Excess of Air, %	Cubic Feet of Combustion Per Sq. Ft. of Grate Area		
			Pocahontas	Pittsburgh	Illinois
5	50	50	2.7	2.9	4.3
3	50	50	3.2	3.7	5.3
2	50	50	3.6	4.4	6.3
1	50	50	4.0	5.6	8.9
0.5	50	50	4.8	6.8	11.9
5	25	50	2.0	2.2	3.5
3	25	50	2.3	2.7	4.35
2	25	50	2.7	3.1	5.1
1	25	50	3.4	4.0	6.2
0.5	25	50	4.0	5.0	7.1

Combustion Space Required for Various Coals

Different coals require different combustion spaces—the size of the combustion space required being principally determined by the quantity and quality of the volatile matter as indicated by the ratio of volatile carbon to available hydrogen, and also by the oxygen content of the coal on a moisture and ash free basis. As an illustration of the influence of chemical composition of coal on the combustion space required, we include Table II which shows the space requirements for three typical coals under various conditions.

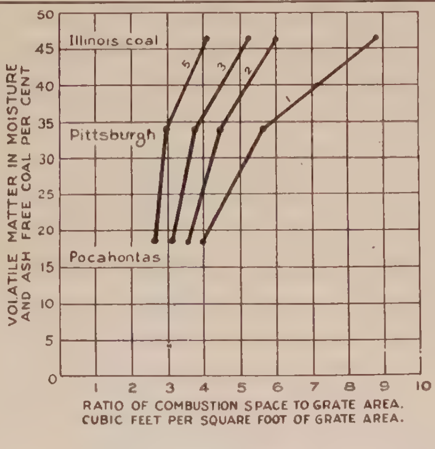


Fig. 3

Fig. 3 furnishes an illustration of the point that the size of the required combustion space is dependent upon both the quantity and quality of the volatile matter and does not depend upon the percentage of volatile alone.

It is well worth while to have the combustion space in your furnaces checked up against the coal which you are now buying. In putting in new boilers be sure that the combustion space in the furnaces is designed for the coal which you can buy to best advantage.

B.t.u. Content of Coal

It is important to know the B.t.u. content of the coal which you are using. It is common to speak of an evaporation of 8 or 9 or 10 lbs. of water per pound of coal as representing a relatively high efficiency. Such figures however mean nothing unless the B.t.u. content of the coal is also given. For example, if coal contains 11,000 B.t.u. per lb. the equivalent evaporation of 8 lbs. of water per pound of dry coal would represent 70.5% efficiency. However if the coal contained 14,500 B.t.u. the evaporation of 8 lbs. of water would represent only 53.5% efficiency.

Pointers on the Purchase of Coal

Complete chemical analyses of coal entering your yard should be made at frequent intervals. If you haven't a laboratory of your own put a barrel in the boiler room, have the fireman throw in a shovel from different parts of the car to be tested, then mix and quarter the contents of the barrel until you have a representative sample which you can forward to the nearest testing laboratory. In making a contract for the purchase of coal under specifications the following points should be taken into consideration:

(1) Amount and description.
(2) Time and conditions of delivery.
(3) Adjustment in price for variations in B.t.u. content, moisture and ash.
(4) Method of sampling.
(5) Designation of laboratory.
(6) Disposition of acceptable coal.

The proper selection of coal is at the very foundation of efficient power plant management. Time invested in the study of this question will pay rich dividends.

Safety Work at Speed Reorganized

Starting Januray 1, 1924, the Safety Work at the Speed mills of the Louisville Cement Co. was reorganized, and the safety competition put on an entirely new basis for the year 1924.

The employes at Speed will be divided into two main groups, one group consisting of the Brixment mill and the quarries, the other group consisting of the entire portland plant. These two groups will carry on a safety competition lasting one year, from January 1, 1924, to December 31, 1924, inclusive. A trophy will be awarded to the group having the best safety record for the year.

Each of these two main groups will be subdivided into safety divisions—three divisions for the Brixment mill and quarries and six divisions for the portland plant. Each group will hold a safety contest between its own divisions entirely separate from the divisions of the other group. These contests will last for six months. At the end of every six months the division having the best record in the Brixment mill and quarries group and the division having the best record in the portland plant group will be entertained jointly by the Louisville Cement Co.

Only such accidents as cause a workman to lose time shall count against the record of a division.

The safety work in each of the two main groups will be carried on independently of the other.

The assistant superintendent of each mill will be in charge of safety work in his group.

There will be a safety foreman in charge of each division, who will be responsible for the safety work in his division. A safety captain or captains will be appointed in each division to assist the safety foreman in his work.—*The Speedometer.*

Production of Bauxite in 1923

The production of bauxite in the United States in 1923 was 522,690 long tons, valued at $3,156,610, an increase of over 72% in quantity and 56% in value as compared with the domestic production in 1922, according to a statement issued by the Department of the Interior, prepared by James M. Hill, of the Geological Survey.

Bauxite Produced and Consumed in the United States, 1922-1923, in Long Tons

Year	Domestic Production	Imports	Exports[1]	Apparent Consumption
1922	309,600	23,656	19,617	313,639
1923	522,690	119,020	78,560	563,150

[1] Largely bauxite concentrates.

Domestic Bauxite Consumed by Industries, 1922-1923 in Long Tons

Year	Aluminum	Chemicals	Abrasives and Refractories	Total
1922	211,550	78,550	19,500	309,600
1923	380,518	68,872	73,300	522,690

In the Arkansas field the production increased from 266,790 long tons in 1922 to 493,880 long tons in 1923, but the production in the eastern field declined from 42,810 long tons in 1922 to 28,810 long tons in 1923. The greatest decrease occurred in the Alabama districts, for the production of both Georgia and Tennessee was greater in 1923 than in 1922.

Making Safety Engineers of the Employes

In promoting safety work at the Houston, Texas, plant, the Texas Portland Cement Co. has adopted a plan by which the workmen determine their own methods and practices. Instead of safety measures being discussed by executives and department heads, later to be prescribed for the workmen, the employes sit as a committee of the whole for each monthly safety meeting.

It is a plan introduced by C. S. Andres. He hit on the plan in an effort to instil interest into the sessions devoted to the welfare of the workmen.

The safety meeting takes place the second Tuesday of each month. From half an hour to an hour is taken. Work is halted for the session. There is a set routine for each meeting. Despite this routine, which is really an order of business, some novel features of the program are introduced to keep the force keyed up for each meeting.

Mr. Andres lets each safety meeting follow this order:

(1) Report of accidents during the past month;

(2) Safety work accomplished during the past month;

(3) A report from some foreman or a talk by some visitor;

(4) Discussion of dangerous practices around the plant;

(5) Suggestions for promoting safety around the plant;

(6) Inspector's report;

(7) Inspections of bulletins to be posted for the month.

The superintendent plays a role similar to that of a toastmaster at a banquet. His function is not that of giving instructions in safe practices in the plant, but rather to so conduct the session that the men will give reports of safety accomplished, hazards that should be overcome, and make suggestions for improving existing safety methods.

The first topic in the regular order of business serves a double purpose. To recall a previous accident is in itself a method of stressing the need of caution throughout the plant. These reports soon run into item number five on the program, for in discussing an accident, the logical process is to suggest means of preventing future ones of the same type. When the discussion takes that turn, it is permitted to proceed, although it may be brought up again when the order of business brings suggestions up for consideration.

Safety work accomplished (No. 2) is another form of report. It serves to prompt the men of one department to ask for methods similar to those already in use in some other department.

The third item is the one that assures interest in the meeting. The men never know what this part of the program will be. From past experience, however, they feel sure it will be something worth-while. When possible, Mr. Andres has a man outside the organization address the meeting. His part may not be merely an address. It may be a demonstration in the use of some sort of equipment.

And safety may be but an incidental part of this talk. Considerable welding is done on repair work in the mill, and the workmen, of course, are interested in welding. A representative of one of the welding supply companies was recently on the program for the safety meeting. He brought all the essentials of a complete welding unit. Then he demonstrated the use of it. Where caution in its use was pertinent, he made it clear. But the major part of this talk was on welding methods.

After it was over, the men were told they could learn more of welding if they desired, as the company would provide time and equipment for the learning of welding methods.

Often some salesman of equipment used in the plant will address the meeting. His talk will not be primarily of safety. But in explaining the intricacies of the equipment, he will find opportunity to stress the points that are necessary if caution is to be practiced. Representatives of the Portland Cement Association sometimes give talks.

When no visitor is available for a talk, a trump card with the Houston plant superintendent is the reading of some safety article from a magazine. He has learned that these need not be exclusively from publications in the cement field, although he seeks for these first.

He seeks first to find an article that is written around the human element. Even where it is the instance of the wife of a linesman, who from hearing her husband speak of safety methods, revives him after he has been knocked from a pole, he has found it possible to get sincere interest from the workmen of the plant while the article is being read. This article gave in detail the correct method of resuscitation from an electric shock, and in that it was a lesson in safety, while interest in it was assured through the human element in the story.

Mr. Andres keeps on the lookout constantly for articles that will do for reading at his safety meetings. He prefers those not requiring more than 10 minutes for reading, and even a 5-minute article he considers better. All he wants from an article is a definite instance of the value of safety, with some topic that will ensure listener interest.

This part of the program consumes about as much time as all the remaining divisions. When a speaker is available, as much as a half-hour is allotted him. The effort is made never to have a meeting continue more than an hour.

Dangerous practices around the plant may have been touched in the report of accidents. When it is reached, a call is made for reports. Then the meeting goes into suggestions for promoting safety. This phase of the sessions has proved extremely valuable. There is a sort of rivalry in it. While the plant has no inspectors without other duties, the foremen, machinists, and the carpenters keep watch for unsafe devices. So the other employees take delight in being able to report something that may have escaped one of the men whose duty it is to catch such things.

This runs into one of the primary causes for the success of the method. Whatever a man may suggest, it gets ample consideration. If it is rejected, he knows the reason. If it is adopted, he gets credit, and the credit is not confined to the Houston plant.

A stenographer is on hand to report all discussion. A complete report of each session goes to offices of the International Cement Corporation in New York. So if an employe suggests a safety measure, the fact goes to headquarters. If it is adopted, headquarters knows it. This is a play on the universal passion for publicity.

One thing that is watched closely in all discussion is that no suggestion is passed over as a trivial matter. As Mr. Andres puts it, "a suggestion is not trivial with the man who makes it."

Scores of suggestions are not worth putting into practice. But they are not passed over until they have been discussed in the meeting, and discussed to the point where those in the session come to the conclusion that the suggestion is unworthy. If possible, the other employes are left to convince the one making the suggestion of its futility. This is but part of the practice of permitting the workmen to determine their own safety methods and measures.

Safety First Bulletins that are to be posted for the month are passed around at each meeting. This is done to ensure their being read.

Nearly all belts have been discarded in the Houston plant. Where these formerly were used, chain drives have been installed. These are inclosed. All moving parts of the plant are guarded. Vertical ladders are guarded with metal staves.

The whole effort of the plan is to make safety a personal matter. In doing this, it first is made evident that the concern through its executives has no desire to preach safety just for the sake of recommending something. Unless it is to the interest of the individual, the concern does not want it. Then the plan goes about bringing the workman to the point that he sees the necessity of safety for his own welfare.

There are no records to show the efficiency of the plan in comparison with other methods. But it is working and giving satisfaction.

British Portland Cement

The British cement industry has attracted more than customary attention during the past twelve months, according to press reports. Some light on the position is obtainable from the report published by the British Portland Cement Manufacturers, Ltd. The directors state that there was a slight improvement in the demand for portland cement. Lower prices were realized in both the home and export markets, thus reducing trading profits from that source. The company, however, secured a better return from investments, so that the revenue for 1923 at £449,419 was only £1,803 less than for the previous year.

A sum of £125,000 has again been placed to general depreciation reserve, and the ordinary shareholders are to receive a 10% dividend for the whole year, for the third year in succession. Last October a considerable sum was advanced to an allied company to enable it to purchase the ordinary share capital of the Humber Portland Cement Co. The balance-sheet shows an addition of £545,200 to the companys' investments, which are taken at cost, but the cash in hand has been reduced by £192,097 to £112,906. The ordinary shares of the company are now 25s.

Mozambique Cement

The opening by the Governor-General of Mozambique of the new factory near Lourenco Marques of the Mozambique Portland Cement Co., Ltd., marks a notable step in the progress of this concern. In May last, this company made an issue of debentures and ordinary shares in England. It is now estimated that of the total issued capital of just over £300,000 at least £150,000 is held here.

Prospects appear to be good. The company has a monopoly of cement-making in the Province for 20 years. Its supply of raw material is abundant. Labor and coal are cheap, while the prospective market for its products is a steadily growing one. As the Governor-General pointed out, large orders have been received from the government, which has important development works in view.

Magnesite in 1923

The Department of the Interior announces through the Geological Survey that statistics compiled by J. M. Hill show that the magnesite material marketed in the United States in 1923 from domestic mines was equivalent to 147,250 short tons of crude magnesite, valued at $1,103,700, an increase of 164% in quantity and 93% in value, as compared with the quantity marketed in 1922. As the value is based on the price of crude magnesite f. o. b. mines, and as about 50% of the output—a much larger percentage than usual—was made in the State of Washington, where the operators place a low value on the crude uncalcined rock, the increase in value in 1923 was low as compared with the increase in quantity.

Eight producers of magnesite in California in 1923 were operating at 11 localities in Napa, San Benito, Santa Clara, Stanislaus, Tulare, and Tuolumne counties. In Washington the output came from three properties near Valley and Chewelah, in Stevens County.

The reports of the Bureau of Foreign and Domestic Commerce show that the magnesite material imported for domestic consumption in 1923 amounted to 5182 short tons of crude magnesite, valued at $44,081; 10,928 tons of caustic calcined magnesite, valued at $306,610; and 61,726 tons of dead-burned magnesite, valued at $707,383. These figures appear to indicate that the foreign producers can mine and calcine magnesite more cheaply than the domestic producers. No crude or calcined magnesite was exported.

MAGNESITE (EXPRESSED AS CRUDE) CONSUMED IN THE UNITED STATES 1918-1923, IN SHORT TONS

Year	Domestic Production	Imports	Apparent Total Consumption	Proportion of consumption Supplied by	
				Domestic	Foreign
1918.......	231,605	43,530	275,135	84	16
1919.......	156,226	25,321	181,547	86	14
1920.......	303,767	63,110	366,877	83	17
1921.......	47,904	65,569	113,473	42	58
1922.......	55,790	217,861	273,651	26	74
1923.......	147,250	150,490	340,829	43	57

The table shows that the domestic producers regained in 1923 some of the market they lost in 1922, largely, probably, because of the protection afforded by the new tariff act. Operators report, however, that even with the present tariff it is almost impossible to compete with either dead-burned or caustic foreign magnesite in the eastern markets on account of the great cost of production and high freight rates.

Chemical Equipment Exposition

The first National Chemical Equipment Exposition will be held in the State Armory, Providence, Rhode Island, June 22 to 27 inclusive, 1925, under the management of the Chemical Equipment Association and in conjunction with a regular four-day meeting of the American Institute of Chemical Engineers.

It is pointed out that the Chemical Equipment Exposition is distinctly a product of conditions within the chemical and chemically controlled industries and that are inherent in the relationships between these and the industries that cater to them. Both the executives, technical men and superintendents of industrial plants in the chemical and chemically controlled industries and the manufacturers of chemical equipment acutely need a common meeting place for the examination and display of essential equipment and operating supplies, where a trade atmosphere will prevail and the personal element, both among buyer and seller be given opportunity for emphasis.

Men and Mills

Notes from the Field

A new cement plant has been started by the Southwestern Portland Cement Co., of Los Angeles, Calif., at Osborn, Ohio, in the vicinity of Dayton. Carl Leonardt, president, and O. J. Binford, secretary of the Southwestern company, have been at the site of the new plant getting construction operations under way. The estimated cost of the plant is placed at approximately $2,500,000. The company already operates plants at Victorville, Calif., and El Paso, Texas.

The net income of the International Cement Corp. for the first quarter of 1924 is reported in the *New York Journal of Commerce* as $442,013 after expenses and charges. This is equal to $1.14 a share on the 364,167 shares of the common stock outstanding after allowing for accrued preferred dividends.

It is reported that during the first quarter domestic shipments were somewhat curtailed, due to unusually inclement conditions. Enlargement of the Kansas plant is expected to be completed toward the close of the current quarter.

James Clifford, former clerk for the Lehigh Portland Cement Co., at Allentown, died on April 11, at the age of 52 years.

The recent meeting in Allentown, Pa., of safety men from the Lehigh and Hudson districts emphasizes the commendable work that has been achieved by these men and the organizations in the decade during which safety work has reached its present recognized position.

When the safety men got to work studying machinery and men and threw around the former all the possible guards and drilled and instructed the men in safety methods, results began to show daily in the lack of news of accidents in the cement field. According to reports from Allentown, results are shown in another way which has proved that this humane and intelligent study by the safety men has likewise been a dividend payer, the compensations for injuries in the industry amounting to only $53,000 last year, although many thousands of workmen were employed in jobs that formerly were extremely hazardous.

Rudolph P. Miller, consulting engineer of New York City, has been elected president of the National Fire Protection Association for the year 1924-5.

L. D. Albin, formerly general sales manager of the Ingersoll-Rand Co., 11 Broadway, New York City, has been elected vice president in charge of European sales of that company. D. C. Keefe, formerly assistant general sales manager, has been appointed to succeed Mr. Albin as general sales manager.

The Building Officials' Conference, which was held at Louisville the week of April 8th, was brought to a close by a visit of these gentlemen to The Louisville Cement Co.'s works at Speed, Indiana.

The party consisted of about fifty building inspectors and other officials, representing fifty-five of the largest municipalities of the United States.

Upon their arrival at Speed, they were conducted through the Brixment plant, over to the quarry, and then through the portland mills. All phases of the manufacture of both Brixment and Speed portland cement were explained to them in the minutest details. They were also given an opportunity to inspect the new buildings under construction, as well as the church and the community house.

Fire that for a time threatened to communicate to other parts of the plant entirely destroyed a three-story brick building at the plant of the Whitehall Cement Manufacturing Co., at Cementon, May 18. Although the origin of the blaze has not been fully determined, it is surmised the building was struck by a bolt of lightning during the severe rainstorm just before six o'clock. The loss, as yet not estimated, is fully covered by insurance.

The cement mills of the Birmingham, Ala., district are supplying large amounts of cement for concrete work at Muscle Shoals, on the Tennessee River, which is being done by the government.

The latest order for this work calls for 56,000 bbls. This is to be used on the construction of the Wilson Dam, at Muscle Shoals. The contract went to the Atlas Portland Cement Co., the Phoenix Portland Cement Co. and Lehigh Portland Cement Co., of Birmingham; and the Dixie Portland Cement Co., of Chattanooga, Tenn. The first two mentioned companies received orders for 20,000 bbls. each. Additional orders for several thousand barrels are still to be placed.

The cement mills of the Birmingham, Ala, district are operating on full time, and are receiving all the orders for cement they are able to fill.

The annual meeting of the stockholders of the Tidewater Portland Cement Co. was held in the company's Union Bridge, Md., offices, May 19, at which time directors of the company were elected.

Frank C. Caldwell, a director of the Link Belt Co. since the purchase of the H. W. Caldwell & Son Co. by the Link Belt Co. in 1921, was stricken with heart failure, May 15, while on his way to his bank. He died in an ambulance en route to a hospital.

"The Story of Portland Cement" is the latest addition to the series of industrial motion picture films released by the Dept. of the Interior, through the Bureau of Mines. It was prepared in cooperation with the Portland Cement Association in commemoration of the 100th anniversary of the invention of portland cement in 1824. The film shows "more than 1000 uses" to which portland cement is put, including building construction, highways, and sculpture.

At a "Safety Slogan" contest among the employees of the Tidewater Portland Cement Co., twenty-two slogans were submitted, all of which were worthy of heed in the great safety movement. George K. Millen was awarded first prize with the slogan "Life is not long enough for playing the fool," and Russell Grimes received second prize with:

"Safety First is taught,
It's a thing that should be sought,
And by doing so would fill
The place below with noughts."

In explanation of the slogan winning second prize, the company requested a suitable slogan for insertion at the top of its accident record cards showing the accidents for each month in each year from 1921 to date, these cards being posted throughout various departments.

The Newaygo Cement Company's plant is now in full operation with three kilns. The company's new plant at Manitowoc started operation May 15 with President Clay H. Hollister, of Grand Rapids, and other officers of the company in attendance.

Joseph J. Heinzelman, Allentown pioneer railroad builder and industrial promoter in the cement and slate regions of Northampton Co., Pa., died recently. Both railroads with which Mr. Heinzelman played such a prominent part, quickly opened the territory through which they ran, and became important transportation lines. They make possible the delivery of slate and cement to large railroads, by which these products are carried to the markets of the world.

The Lehigh Portland Cement Co., with headquarters in Allentown, is being forced out of competition in a large section of the southwest territory at port terminals because of "unfair, unlawful, and prejudicial discrimination in freight rates," its officials charged in a complaint filed with the Interstate Commerce Commission recently, according to a report from Washington.

Specific complaint is made that many former customers of the Lehigh company are now placing their orders elsewhere, and the Commission is informed that this condition will persist and doubtless be aggravated unless the railroads are compelled to revise their tariffs from Lehigh Valley territory and at other points at which the Allentown concern's manufacturing plants are located.

It is expected that the case will be warmly contested before the Commission, since the Allentown company cites a number of competitive firms that it says are encroaching upon natural trade territory in which it competed freely before rate changes were made that put it under serious handicap.

The cement subsidiaries of the United States Steel Corp., which are now producing at the rate of about 15 million bbls. per year, have been out of the market as sellers for some time, and the same is true of other large manufacturers. The construction of cement roads, leading to heavy purchases by various states, is one of the main factors in the situation. It is estimated that orders for cement for road work placed in recent weeks have reached a total of between 5 and 6 million bbls., according to an item in the *Daily Financial Review* (N. Y.).

Ex-Councilman Allen S. Heckman, of Catasauqua, died recently at Allentown, Pa. Mr. Heckman has been superintendent of the car department, Northampton plant, of the Atlas Portland Cement Co. for the past 25 years.

Additional group life insurance protection is provided for the 119 employees of the Taggart Brothers' Co., of Watertown, N. Y., manufacturers of cement bags and wrapping papers, through a policy just placed with the Metropolitan Life Insurance Co.

The Bradley Pulverizer Co. reports that its plant is working at its greatest capacity with orders that will keep operations at full speed for several months.

Among the orders recently received are included: Two installations of Bradley Hercules mills for the International Cement Corp.'s plant in Argentine; two installations for the International Cement Corp.'s plant in Uruguay; two installations for the Kosmos Portland Cement Co., at Kosmosdale, Ky.; two installations for the new plant of the Clinchfield Portland Cement Corp., under construction at Coreen, Ga.; complete installation of grinding departments for the new National Cement Co., at Montreal, Quebec.

In addition to this, the company has recently sold and installed mills for the Lehigh Portland Cement Co., at Fogelsville, Pa. The Wellstone Iron Furnace Co., at Superior, Ohio, has just started an installation; an installation capable of producing 20,000 bbls. of clinker per day has been shipped to the Universal Portland Cement Co., at Universal, Pa.

The Bradley company's Griffin mills have been recently supplied to the Kansas Portland Cement Co. for its clinker grinding department at Bonner Springs, Kansas, and to the Wolverine Portland Cement Co., at Coldwater, Mich.

The Giant Portland Cement Co., at Egypt, Pa., has just remodeled its raw end, using Bradley Hercules mills as preliminary pulverizers.

O. J. Binford, former superintendent of the Southwestern Portland Cement Co., at El Paso, Texas, has gone to Dayton, Ohio, to take a similar position at the company's new plant which is being constructed in that locality. Mr. Binford has been succeeded by H. E. Nichols, formerly assistant superintendent of the Southwestern company, according to advice from El Paso. R. R. Cochland has been promoted to chief chemist, and Wm. McKenzie to assistant chemist ta El Paso.

J. E. Zahn, general manager of the United States Portland Cement Co., Denver, Colo., who served his full time as chairman of the Transportation Committee for the Denver Civic and Commercial Association, has retired in favor of Burt Coldin, president of the Hallack and Howard Lumber Co.

The International Cement Corp. has taken an option on the property of the Giant Portland Cement Co., in South Norfolk, Va., and the matter is now being checked and investigated.

The property under option to the International company is described as an 11-acre tract, fronting on the southern bank of the Elizabeth river, and connected by rail with the Belt Line railroad.

Twelve cottages to be used as homes for the workmen at the new plant of the Trinity Portland Cement Co., now under construction at Fort Worth, Texas, are already finished, and a complete network of railroad tracks to all sections of the grounds is ready for use.

Charles Boettcher, president of the Cement Securities Co., Denver, has accepted the chairmanship of a committee to select a suitable site for a large stadium to be erected in the Mile-High city.

In 1923 the Lehigh Portland Cement Co., with its 16 plants located from coast to coast, supplied a total of 16,500,000 bbls. This is about as much cement as was produced 25 years ago by the combined cement industry of the United States.

The National Safety Council will hold its Thirteenth Annual Safety Congress in Louisville, Ky., September 29 to October 3, it was announced by W. H. Cameron, managing director, following a meeting of the executive committee in Chicago recently. The industrial sections of the Council already have begun to plan programs for the sectional meetings at the congress, and the business and industrial leaders of Louisville are organizing committees to arrange the many details and to cooperate with the officers of the National Safety Council in preparation. Officials are planning for an attendance of more than 4,000.

New Relay Has Self-Contained Ammeter

A line of overcurrent and directional relays equipped with a current indicating element is a product of recent work by the Westinghouse Electric and Mfg. Co. in the field of protective devices for electrical circuits. These relays, known as COA and CRA, differ from the standard Westinghouse CO and CR overcurrent and directional relays in that they have self contained ammeters which give a continuous indication of the current flowing in the circuit to which the relay is connected. They are designed for use where the relays are mounted on the front of a switchboard and where there is insufficient room to provide separate ammeters. They are recommended by the manufacturers as particularly desirable where it is considered advisable to have continuous supervision over the current circuit of the relay.

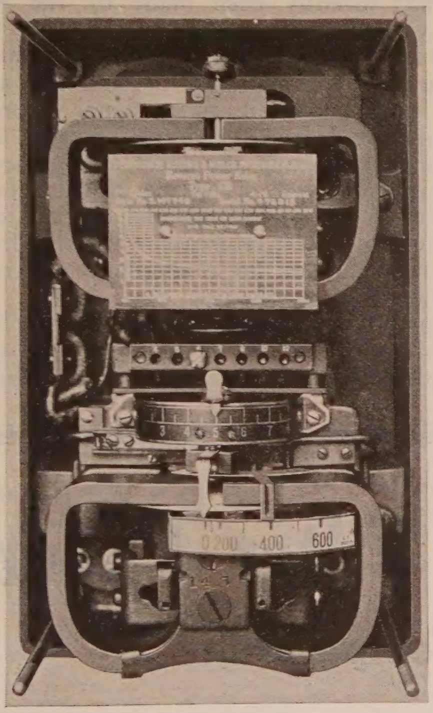


Fig. 1—Westinghouse Type CRA Directional Relay

In addition to operating as protective relays, these relays indicate the current flowing through the relay circuit, which not only shows the current in the feeder but also proves to the operator that the relay is receiving current through its circuit and is therefore in condition to operate if a short circuit should occur.

The indicating element of this new relay consists of a thin copper disc mounted on a separate shaft and having its own jewel bearing and control spring. It is actuated, however, by the same flux which operates the main disc to close the contacts of the relay. This prevents the indicating element from operating when there is any trouble either inside or outside the relay that would prevent the main electro-magnet from being energized.

Trade Publications

A booklet issued by the Advance Waterproof Cement Co., 2035 S. Dearborn St., Chicago, describes Advance reground portland cement as an integral method of waterproofing portland cement, concrete, plaster, stucco, and mortar for all purposes, and Advance hydro-corundum portland cement for a waterproof and permanent portland cement concrete floor and stair finished topping.

It is claimed for Advance reground portland cement that it is true and genuine portland cement, reground to the fineness of talcum powder, thereby obtaining more colloidal efficiency, waterproofing value or cement glue than is produced by the standard specification for the fineness of portland cement. It is further claimed that it is equally as strong, efficient, and fire resistive as any standard brand of portland cement, but in addition, it renders portland cement concrete, plaster, stucco, and mortar in which it is used non-absorbing and impenetrable by water or moisture.

The product is produced by patented scientific process of regrinding by means of special machinery designed for the purpose.

Specifications for the Advance reground portland cement and for the use of Advance hydro-corundum are included in the booklet.

Richardson Apron Feed Automatic Scale, is the name of a 32-page catalog, Bulletin 1224-G, recently issued by the Richardson Scale Co., Passaic, N. J. This scale is an automatic machine, designed to weigh crushed, lumpy and granular materials of specified test weight, continuously, without attendance, in repeated equal loads, and to register the number of discharges made, all without interposing any restricted opening for material to pass through. Specifications for weighing of coal only, together with diagrams, are given in the back of the catalog.

Industries Urged to Store Coal

Industrial consumers of coal have been advised by Secretary Hoover to purchase and store coal this summer to avert a car shortage in the fall. A letter addressed by the Secretary of Commerce, May 10, to all national and state trade associations declared that car shortage was prevented last year by this means. The manufacturers should take reserves of coal during May, June, and July, said Secretary Hoover, in order to eliminate competition with the household movement later in the year. He pointed out that the lowest prices for bituminous coal prevail during those months. Cheaper coal eventually may be secured, he said, by adhering to the purchase and storage plan every summer, thus maintaining more regularity in production.

International Cement Congress

A gathering of those interested in the use of cement throughout the world was held in Olympia, London, England, April 22-23, 1924. The following topics were discussed at the meeting: (1) Ciment fondu in practice, (2) surface dust on concrete floors in factories, (3) cement in sea water, (4) cement in concrete roads, (5) preparations to withstand oil, (6) influence of size and shape in compression test blocks, (7) microscopy of cement, (8) porosity of concrete blocks, (9) use of sea water in mixing cement.

In addition, facilities were provided for those in attendance to visit prominent English cement manufactories.

Seek New Uses for Slag

Betterment of present methods of utilizing the slag produced as a waste product of blast furnaces, and research looking toward the development of new methods of using it, were discussed at a conference of the National Slag Association held at the Bureau of Standards, Department of Commerce, recently. In addressing the conference, P. H. Bates, of the Bureau of Standards, called attention to the fact that slag is now used in Europe for making "Eisen portland cement," which consists of about 35% of ground slag and 65% of portland cement. He expressed the opinion that such use would ultimately develop in this country. Eisen cement is nearly as strong as portland cement, he stated, and is also thought to be more resistant to attack by sea water and by alkali.

New Leak-Proof Sleeve Bearing for Electric Motors

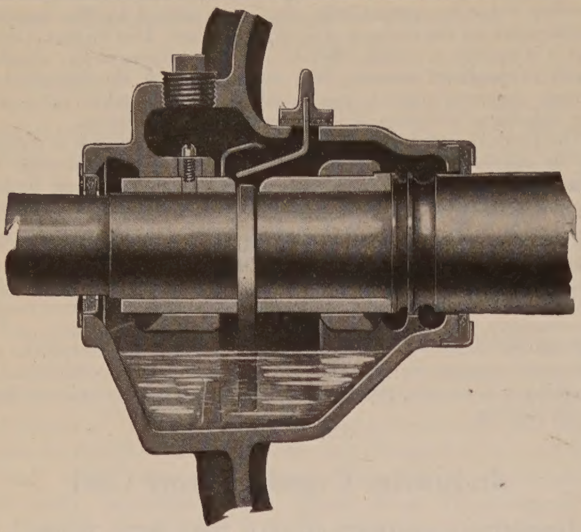


Fig. 1—The Sealed-Sleeve Motor Bearing, Showing How Effectively This Bearing is Sealed Against the Entrance of Air or Dust and Prevents the Leakage of Oil or Oily Vapor into the Motor

A new type of sleeve bearing for electric motors, designed to prevent the leakage of oil into the windings, or the entrance of dust and grit into the bearing, has been developed by the Westinghouse Electric & Manufacturing Co. This new bearing, which is known as the Sealed-Sleeve bearing, is so constructed that it is almost airtight, preventing air from getting in and oil from leaking out.

The principal methods used to improve the conventional bearings are comparatively simple. A connecting passage in the upper part of the bearing housing secures a condition of balanced air pressure in the separate chambers into which the housing is divided by the bearing supports. The action of the blower at high speeds sets up a vacuum next to the inside end of the housing, and, since it is impossible to seal the housing absolutely at that point because the shaft passes out there, the vacuum is communicated to the space within the housing itself. If the upper passage were not provided, an unbalanced air pressure would result whenever the oil level rose high enough to close the lower cored openings.

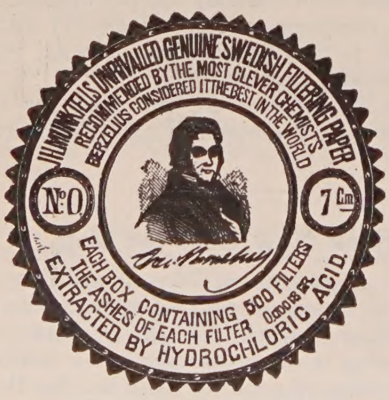
The bearing requires practically no attention, and oiling once or twice a year is generally all that is necessary.

An advance in the art of oxy-acetylene cutting apparatus has recently been made by the Alexander Milburn Co., Baltimore, Md., in the perfection of a super-tip for cutting which it is claimed embodies all the features of the standard tip and has additional features which mark it as a signal improvement. The distinctive features claimed for this tip are a method of super-mixing the gases and preheating the cutting oxygen as well as giving added velocity and penetration to the preheating and cutting jets. The tip is provided with a renewable seat at a fraction of the cost of a complete tip, rendering it unnecessary to re-machine or discard the used tips.

The super-tip with renewable seat is interchangeable with all sizes of Milburn cutting tips and will fit all this company's torches manufactured since 1916.

Munktell's Swedish Filter Paper

The Standard for Comparison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